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SIR CHRISTOPHER WREN

THE BUST BY EDWARD PIERCE IN THE ASHMOLEAN MUSEUM, OXFORD

This has been dated 1673 by a letter written by Christopher, the architect's son, in which case it would represent Wren at the age of 41. The R.I.B.A. possesses an early plaster cast and a marble copy with some variations.

JOURNAL OF THE
ROYAL INSTITUTE *of* BRITISH ARCHITECTS

VOL. 39. 3RD SERIES 15 OCTOBER 1932 No. 20

Journal

The article on Electrical Equipment which fills the greater part of this JOURNAL is the first in a series of technical articles which we hope to publish during the coming year, as an attempt to provide for practising architects reliable and up-to-date information on a few of their innumerable problems. So widespread are the demands made by even the smallest or most specialised practice that no architect can easily keep abreast of invention and development. Although more is being done every day by the various bodies whose function it is to help the profession it is, unfortunately, true that the profession has by no means yet learnt how to make the best use of that help which is freely offered by such institutions as the R.I.B.A., the Research Station and the new Building Centre.

In another part of this JOURNAL is the preliminary announcement of a "refresher" course which has been organised by the Board of Architectural Education and the Research Station as a further attempt to help the practising architect. "Refresher" courses have for long been a feature of education in the medical profession, and though they have not hitherto been tried in architecture it is no less necessary for architects than for doctors to keep abreast of the times. We have little doubt that the profession will respond to this effort on its behalf, and will also appreciate and use the information given by the JOURNAL articles, concerning which a few words may be added to explain in more detail their purpose and scope.

As far as possible the subjects chosen will be those that have not been adequately covered elsewhere, so that a genuine need may be met. Generally each article will deal in as much detail as possible with one department of a subject rather than attempt to cover the whole ground in a sketchy manner. For example, the present article is only concerned with the equipment of small houses; if more had been attempted less would probably have been achieved. Even so, this article has run to such a length that it has been necessary to print it in smaller type than is really desirable, but we felt that rather than contract the article and so restrict its value this expedient of smaller type would have to be accepted with as good grace as possible.

Anyone who writes on technical matters knows only too well that invention does not stand still for the printed word and practically nothing can be written that does not run the risk of being out of date before it appears in print. The writers of these articles, however, are perhaps luckier than the writers of books, since the few weeks that elapse between writing and publication is nothing compared to the months taken in the publication of a book. There are certain to be some who will feel that they have information to add to what is given here. We hope that they will not hesitate to contribute their ideas to the profession as a whole through our correspondence columns. As long, however, as the series is able to be of real service to some of our members its purpose will have been fulfilled.

As a result of the dance and raffle held at Olympia during the Building Trades' Exhibition one thousand guineas has been given to the funds of the Architects' Unemployment Committee. To the imagination and initiative of Mr. H. Greville Montgomery we owe an inestimable debt of gratitude, for had it not been for him there would have been neither dance nor raffle and the opportunity thus given to many hundreds of people to contribute so substantially to the relief fund. Mr. Montgomery, by bearing himself all the expenses, has made a personal contribution which can only be assessed adequately by those who were present at the dance and were able to enjoy the perfect supper that preceded it, the refreshments and the perfect floor and band, all of which and much more besides were personally due to him. The opportunity was provided and the response exceeded our most sanguine hopes, so much so that at the last moment a breathless reorganisation was necessary to accommodate almost 500 diners and dancers where only half that number had been expected. The dance was the first venture to be undertaken by the R.I.B.A. Social Committee, and its success has given an encouraging start to the committee's work, which should have good opportunity of showing its usefulness during the coming session.

In the body of the JOURNAL is a more detailed account but we must express our thanks here to the anonymous donor who doubled the amount received in the raffle, thereby making a personal contribution of over £300. Finally, a word of appeal, let no one think that, even with this substantial addition to its funds, the Relief Committee has all the money it needs. It is essential that regular contributors should continue their subscriptions. In addition to the satisfaction that may rightly come from a work of charity, subscribers can have the assurance that the work being done by those whose salaries they are helping to pay is of real importance.

Many thousands of people must have had the housing problem brought home to them more forcibly than ever before by the excellent section organised by the London Housing Association at the Building Exhibition. "New Homes for Old" was the evangelistic title of the display which with vigour and with a clear-headed resolve not to mince matters showed by plans and models and charts of statistics how urgent is the problem of slum clearance in this country. Not even the casual passer-by can have failed to receive a pang of conscience that *he*, as a citizen of this country, is directly responsible for the continuance of these appalling conditions, conditions that exist in almost every town and village as a festering wound spreading its foulness into every limb of national welfare. Only by pricking individual consciences into the state that begets active work can we hope to heal the wound and clear away its cause. Mere theorising, sentiment and squeamishness were all absent from the exhibition. That was its power. It was an unbowdlerised story and a true one.

So much really good building has been done both by official bodies and by voluntary housing associations that we are apt to think that however bad things may be they are getting better. Sir Raymond Unwin, in his opening speech, showed clearly how unwarranted by any facts is this complacency. The housing completed, considerable as it is, has not even kept pace with the growth of population, so that in Greater London alone there were at the date of the 1931 census 592,364 more separate families than structurally separate dwellings, an increase of 50,120 over the figures for 1921. While in one place a slum area may have been rebuilt, almost alongside a new slum may have grown up.

The exhibition, said Sir Raymond, hoped to establish three main points: the urgent need for slum clearance, the importance of good design and amenity, and the necessity for some form of subsidy to enable decent accommodation to be provided at rents within the means of those who most need the houses. This last point is intimately connected with the whole question of the false economies that have resulted in such wholesale cessation of building work. Every week that passes aggravates the evil and makes the solution harder to find in the future, and those, as Sir Raymond said, who initiate steps which tend to retard the solution of our housing problems are incurring a very serious responsibility. The architectural profession is peculiarly fitted to assess the dire need for slum clearance, and it is incumbent on every member of it to follow Sir Raymond's lead and to lose no opportunity in making known the urgency of the problem. The facts are now and have always been before us, but it is only by continual insistence on them that such an overwhelming weight of opinion can be stirred that really effective action will result.

At the conclusion of the special service at St. Paul's Cathedral on 20 October, in memory of Sir Christopher Wren, wreaths will be placed on his tomb in the Crypt by representatives of various Learned Societies. Sir Raymond Unwin will place the R.I.B.A. wreath on behalf of the Royal Institute and its Allied Societies, and he will also lay wreaths which have been sent by La Société Centrale des Architectes and the Architectural League of New York. His Excellency the Swedish Minister in London, Baron Erik Palmstierna, will lay a wreath on behalf of the Svenska Arkitektföreningen, Stockholm, and Dr. John A. Pearson, F.R.I.B.A., of Toronto, Past-President of the Ontario Association of Architects, will lay a wreath on behalf of that body. The wreath from the R.I.B.A. will bear the following inscription:—"In reverend admiration for the genius of Sir Christopher Wren, a great architect, a great gentleman, this wreath is offered as a tribute to his immortal fame by the architects of Britain."

Special seats have been allotted in the Cathedral for members of Learned Societies, and one hundred of these are for the R.I.B.A. Any members of the Institute who wish to be present are asked to apply to the Secretary immediately; but though these special seats have been reserved, no one without a ticket need fear that he will be unable to get a seat in the Cathedral, as there is certain to be ample room for everyone in the free seats. The service will start at 4 p.m., and is expected to be over at about 5 p.m. All attending are specially asked to be in their places in good time.

We wish to call attention again to the other arrangements in connection with the Wren tercentenary. On 21 October, at 5 p.m., Professor Beresford Pite is to read a paper to the London Society in the Hall of the Royal Society of Arts on "London's Debt to Wren." The Dean of Westminster will be in the chair. Yesterday, Canon Alexander gave the first of his two lectures for men on the life and work of Wren; the second is to be on 21 October. These are being given in the Crypt of St. Paul's Cathedral.

The example set by the Norfolk and Norwich Association of Architects in organising an architectural exhibition of photographs as a means of displaying the work of Norfolk architects during recent years is an excellent one which will, we hope, be followed by other Allied Societies. It is true that the ideal way of displaying architectural work is to take people to see the actual buildings, when every detail of site, colour, plan and material can be absorbed, but since it is impossible to exhibit to a large public a number of scattered buildings in this way, an exhibition of photographs, which can be easily and cheaply organised, is an effective alternative. Photographs are easily arranged; they are less costly than models; and, to the layman, they are more intelligible and therefore more effective than complicated plans. By means of such an exhibition buildings, which otherwise might receive little attention, are brought before the public for criticism and appreciation, and the wider interest and knowledge which result must be beneficial to progress in building.

SMALL DOMESTIC ELECTRICAL INSTALLATIONS

BY H. B. LEIGHTON, A.R.I.B.A.

(R.I.B.A. SERIES OF TECHNICAL ARTICLES. No. 1)

INTRODUCTION

THE modern electrical installation in even a small house is a much more elaborate affair than was considered adequate twenty years ago, as not only has the demand for more light followed developments in lamp manufacture but most houses which have a supply of electricity use it for purposes other than lighting.

Electricity, properly used and controlled, is a very safe form of energy, but the risks arising from faulty or inadequate installations have been considerably increased by the employment of higher voltages and the more general use of alternating current. The great increase in the size of generating plant, mains and transformers has also made it more essential to have first-class installations as the amount of current which can flow momentarily when a fault or short circuit occurs is often very large and some apparatus of the old type is not able to deal with it.

The meanings of the terms in general use in electrical work are now fairly well known, but for the benefit of non-technical readers the following explanations are appended:—

The Volt is the unit of electrical pressure just as a foot head is the unit of water pressure.

The Ampere is the unit of rate of flow of an electric current, much the same as the velocity in a stream, to continue the analogy with water.

The Ohm is the unit of resistance, or electrical friction, and just as the friction of the rough bed of a stream will reduce the velocity so does the resistance of a wire reduce the rate of flow of current through it. The ohm is equal to the resistance of a column of mercury 106.3 cm. in height and 1 sq. mm. in cross section at 0° C.

The volt, ampere and ohm are related to each other to the extent that pressure is necessary to maintain a flow against a resistance. If the pressure is 1 volt and the resistance 1 ohm, the rate of flow will be 1 ampere. If a time element is introduced of one hour we then have the ampere-hour.

Watts are volts × amperes and if the time element is introduced we have the watt-hour. A kilo-watt is 1,000 watts and with time introduced again we have the kilowatt-hour, or Board of Trade Unit, the measure by which electrical energy is usually sold for domestic consumption. Abbreviations are kW. or K.W., and kWh, or K.W.H. Direct current meters are usually ampere-hour meters calibrated for the particular voltage to read kilowatt-hours, but if the voltage varies they are not quite accurate, as the voltage variation is not taken into account.

A Megohm is a million ohms and is the term used in testing insulation resistance and also for other high resistances.

SYSTEMS OF SUPPLY

The current supplied from public mains may be either "Direct" or "Alternating," "Direct" current being also known as "Continuous" current.

Direct current as supplied by a battery is a straight line current of constant pressure, or practically constant pressure, but when supplied from a dynamo there is a slight ripple produced by the commutator of the machine, although this is not noticed in the light from incandescent lamps. Direct current apparatus has also definite positive and negative poles and the current always flows the same way round the circuit, leaving the dynamo or battery by the positive pole and returning to the negative pole.

The author desires to express his thanks to the following firms for supplying the illustrations : Messrs. Belling, D.P. Battery Co., Credenda Conduits Co., Edison Swan, Evershed & Vignoles, Gilbert Gilkes & Gordon, R. A. Lister & Co., M.E.M. Electric Co., M.K. Electric and Power Equipment Co.

Where there is a small private plant the current is usually direct current because a small dynamo is cheaper and more simple to operate than an alternator, and a battery of accumulator cells may be installed to supply current when the plant is not running, whereas with alternating current the plant must run whenever current is required.

Electricity cannot be stored and an accumulator merely converts electrical energy into chemical energy during the time it is being charged and reverses the process during discharge, the loss in the conversion being about 25 per cent.

Alternating current has not a straight line characteristic, but both voltage and amperage rise and fall, rising to a maximum in one direction, falling to zero, then rising in the opposite direction and falling again to zero, and so on. Each pole is, of course, alternately positive and negative, and the complete rise and fall in both directions is known as a "cycle" or period. Fig. 1 shows the principle of alternating currents. The voltage at the peaks is $\sqrt{2}$ of the mean voltage as measured by a voltmeter, so that on a circuit of 230 volts mean pressure the peak voltage is rather over 320, and this is one reason why old installations sometimes break down when changed over from direct to alternating current of the same nominal voltage.

Fig. 1 indicates a single-phase current and Fig. 2 shows the principle of three-phase currents, in which three sets of current or phases are taken from the same alternator at 120 degrees apart in the windings and the phases follow each other in regular sequence so that as one phase reaches its peak and begins to fall again, the following phase is rising to its maximum, and so forth. Where the circuit consists of motors, transformers or other apparatus having inductive capacity, the voltage and amperage do not necessarily rise and fall together, but the amperage usually lags behind the voltage, so that on this type of circuit the reading of a voltmeter × reading of an ammeter does not give the true watts at any instant. This is a matter which concerns the power engineer more than the domestic user, as the motors used in domestic work are usually small and the current they take is of no great concern as the meter will register the true watts consumed.

The effect of single and three-phase currents used for driving a motor may be compared with the running of single and three-cylinder engines, the latter having less cyclic irregularity and better balance.

Fig. 3 shows the method of connecting the secondary windings of a transformer to the mains, the three legs representing the phase windings connected together at one end to form a neutral point and the other ends connected to the three "phase"

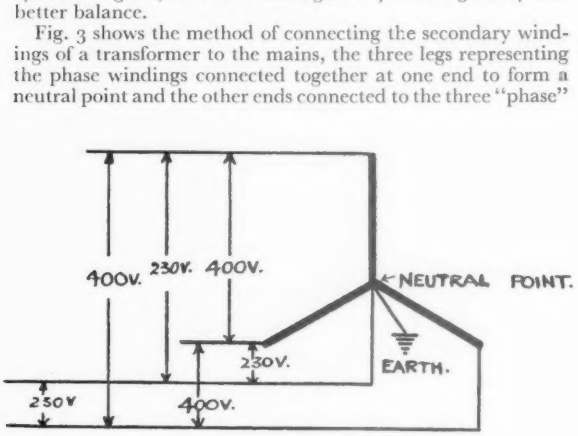

FIG. 3.—TRANSFORMER CONNECTIONS

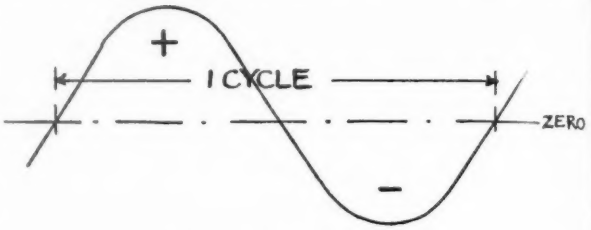

FIG. 1.—SINGLE-PHASE A.C.

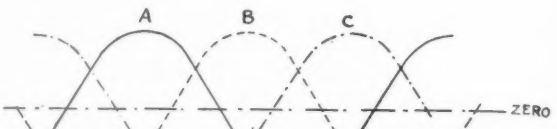

FIG. 2.—THREE-PHASE A.C.

wires in the cables. The neutral point is connected to a fourth or "neutral" wire and also to earth. The ratio of the voltage from phase to neutral and between phases is as 1 : $\sqrt{3}$, or as 230 : 400, as indicated in the figure. This is the usual method of connecting the transformers to the low tension distributing mains and is adopted in all new systems in the British Isles. Single and two-phase currents are still being distributed in some towns but are mostly being replaced by three-phase supplies as opportunity offers.

Within the next few years alternating current will have become almost the only form of public supply in this country, as the direct current supplies are being converted because of the greater ease of distribution of alternating current. The standard frequency or periodicity is now 50 cycles per second and all non-standard stations are being converted and the main stations are being connected to the National "Grid." Voltage standardisation has not been carried out, although it is recommended that it should be 230 volts single-phase and 400 volts three-phase, connected as shown in Fig. 3.

Standardisation will help in reducing the prices of apparatus as fewer types and sizes will have to be stocked.

Three-phase supply is not usually given to domestic consumers except where the amount of current required is relatively large and when three-phase supply is given it is dealt with inside the house as three entirely separate services, unless a three-phase motor is required, when the motor circuit will be wired separately.

Supply undertakings are usually particular about the "out of balance" current on their mains and require supplies taking over 10 to 15 amperes to be split into two or three circuits balanced on the phases. If there is an electric cooker, for instance, taking say 35 amps, it would be supplied from one phase and the remainder of the heating would be put on one or two of the other phases, so that the balance would be approximately maintained.

Services

Where the energy is to be taken from the mains of a supply undertaking, the architect or engineer should ascertain the exact nature of the supply before ordering any apparatus or attempting to design an installation as in some towns there are several types of supply.

Supply undertakings usually bring their mains into the consumer's premises free of cost up to a certain point, which may be from one to ten yards inside the boundary, and reserve the right to decide at what point the service shall be installed. If the position decided upon is inconvenient, or would be outside the building, the undertakers will extend the service to a more convenient position if the consumer is prepared to pay the cost, which will generally be between 6s. 6d. and 9s. per yard for domestic services. The service cable is usually paper insulated, lead covered, steel tape armoured, jute served and compounded overall. Where outbuildings have to be supplied, the cables laid underground from the main building to them should preferably be of the same type as the street mains, but smaller in section. Paper insulation is hygroscopic, so all paper insulated cables must have proper sealing ends fitted and filled with compound, otherwise the cable will soon break down. Rubber insulated cables of the ordinary taped and braided type used for internal wiring should never be run underground in pipes as the moisture destroys the insulation in a short time. For very small underground services to garages and the like, a cheap and satisfactory method is to use rubber insulated lead-alloy sheathed cables of the same type used for internal wiring but laid in stout tarred wood boxing and filled in solid with cable compound.

The supply undertaking provide cut-outs, or fuses, and meters and the consumer is responsible for all work beyond the meters. In some towns and districts the undertakers fix main switches and in these cases the consumer need not provide an additional main switch if the undertaker's switch is inside the building, but it is always advisable to have consumers' main fuses arranged to melt, or blow, at a lower amperage than those of the undertakers. The undertakers' fuse boxes are sealed and if their fuses blow it is necessary to await the arrival of their men before the supply can be resumed, but where the consumer has his own fuses arranged to blow at a lower figure than those of the undertakers he can replace them and continue to use the supply after a temporary fault has occurred or after there has been an occasional overload.

For domestic use, the pressure of the supply may not exceed 260 volts, but this does not prevent a three-phase supply at, say, 230/400 volts being brought into the building, as the phases are separated inside the building as has been explained.

In most cases at the present time, the undertakers bring in either a single-phase two wire supply or a three wire supply connected to the neutral and two of the phases of a three-phase four wire system, and only give three-phase four wire supplies where the house is large and the load considerable.

Country districts are often supplied from overhead mains, the service being slung from the nearest pole to the house, but cheapness is the only recommendation for this system.

It is assumed throughout this article that the pressure of the supply is 200/250 volts and that one of the conductors is earthed at the supply point and suitable allowances must be made for lower voltages; thus if the voltage is 100/110, the amperage rating of such things as main switches, switchplugs, etc., must be approximately doubled and the sectional area of cables likewise increased, having due regard to any other special conditions that may apply in a particular instance.

Wiring Regulations

The "Regulations for the Electrical Equipment of Buildings"* issued from time to time by the Institution of Electrical Engineers, are the almost universally accepted regulations on the subject, and copies should be retained by everyone interested in installation work. These regulations satisfy the Fire Insurance Offices and the suppliers of energy, some of whom have officially adopted them. Space does not allow of their being reproduced here, but they will be referred to from time to time. Though they are fairly stringent, they are practical and should be followed whether it is compulsory to do so or not.

Where installations are to be put in for low voltages from private plants, it is desirable that they should comply with the regulations for the higher voltages, so that they may at any time be changed over to mains supply without alteration, if such a course is desired.

Specifications

The British Standards Institution, until recently known as the British Engineering Standards Association, has drawn up a number of Standard Specifications dealing with electrical apparatus and accessories, and it is desirable to use apparatus and accessories which comply with these specifications, particularly in the case of plugs, which are now made so that those of one maker will fit the sockets of another, whereas under old conditions a house probably contained several plugs which were not interchangeable. Products which comply with B.S. Specifications are usually indicated in the makers' lists.

Many architects, when requiring quotations for electrical work, hand a plan to a wiring contractor and ask him for a price without any specification, or with a specification which sets forth the number and positions of the points but says nothing about the lay-out or materials to be used, except perhaps that they are to be of the "best" quality. The tenders received are probably not comparable as they may be for quite different schemes and different materials, and the contractors who lose the job are aggrieved because their better schemes are turned down. The better class of wiring contractor prefers to tender on a specification drawn up on the same lines as a building specification, commencing with the General Items and Preliminaries and then describing the installation generally and the principal materials in particular. The general lay-out of the installation should then follow, the position of all distribution boards being made clear and the circuits they feed being specified in detail. A schedule of points and their special features may well be added. The specification should leave no doubt about any detail, and should convey the same mind picture of the installation as a good building specification does of the work it covers.

It may not be possible to specify all the fittings, but provisional sums may be inserted for them, and the accessories not supplied with the fittings, such as lamps, connectors, flexible cords, and possibly lampholders, should be included together with fixing. A provisional sum for service costs may be included if there is to be such a cost, and perhaps a small provision for contingencies is not out of place.

Where special accessories, such as distribution boards, switches, etc., of certain makes are desired, they should be specified by their list number, maker, and possibly price as well. When prices have been obtained from the makers for special accessories made up to requirements, as is often neces-

(* Obtainable from the I.E.E., Savoy Place, Victoria Embankment, London, W.C.2, price 1*s.* 2*d.* in paper covers or 1*s.* 8*d.* in cloth, post free.)

sary with distribution boards, it is advisable to give the price in the specification, so that all the contractors do not have to write to the makers and probably get wrong quotations through not furnishing sufficient information for the makers to trace the inquiry.

The plans are usually copies of the $\frac{1}{8}$ inch working drawings and preferably not blue prints, as coloured inks do not show up well on blue. Symbols have to be used to some extent to indicate the points and apparatus, and a key should be added to each plan so that there are no mistakes made in reading them. Coloured inks are useful in indicating the different systems of wiring where several appear on the same plan; thus one may use, say, red for lighting, black for heating, blue for bells, purple for telephones, green for power, etc. The runs of cables are not usually shown on the plans for small work, and it is usually sufficient to indicate the approximate position of the points, the lights which are grouped together on one switch and the position of the switch controlling them, the switch and light positions being connected by lines run directly from one to the other.

B.S. Specification No. 447, 1932, price 1*s.* 2*d.*, should be of considerable assistance to architects and engineers concerned with installation work, as it gives a number of symbols for use on plans, and no doubt in time these will become universal.

WIRING SYSTEMS

The ideal wiring system should be shock proof, fireproof, damp and waterproof, unaffected by change of temperature, easy to instal and reasonable in first cost, but such a system does not exist. The various systems in general use all have their good points and no one system is the best for all possible situations.

Early wiring was usually carried out with rubber insulated cable laid in grooved casing and covered with wood capping, and this system was very successful in dry and otherwise suitable positions, but it was essentially a surface system and is not much used to-day.

The principal wiring systems in general use are :—

(1) Steel Conduit and Cable, in which tinned copper, pure and vulcanised india-rubber insulated, taped, braided and compounded cables, or similar types of cables, are encased in a continuous system of steel tubes, the whole conduit system being earthed by being connected to a cold water main, earth plate or the supply cable sheath.

I.E.E. Regulations say that all metallic conduits or sheathings to cables must be electrically continuous throughout and properly bonded, that the resistance of the conduit or sheathing measured between a point near the main switch and any other point in the system must not exceed 2 ohms, and the sectional area of the earth lead must be at least half that of the largest cable to be protected. The minimum section of the earth lead is 7/22 S.W.G., or 7/·029 inches. Where the earth connection is made to a lead water pipe it is probably best to wipe the earth wire on to the gunmetal or brass of a stop-cock, rather than use a clip round the pipe as a connection, but clips are generally used. The whole length of the earth wire must be accessible and the connections at both ends must be made so that they can be inspected.

As the whole conduit system is electrically continuous and earthed, it forms an easy means of earthing all metallic apparatus throughout an installation.

Classes of Conduit.—Heavy gauge screwed conduit is of two classes, solid-drawn and welded, the solid drawn being much more expensive in the smaller sizes. Welded conduit is usually employed in the best domestic work.

Light gauge conduits are too thin to permit of screwing, so grip and set screw fittings are used with them to maintain continuity. Light gauge conduits are obtainable in solid-drawn welded or brazed, and close-joint types, the latter having an open joint and being the type of conduit most used in cheap work.

It should be noted that in electric conduits, the outside of the tube is standardised, not the bore, and the standard sizes are $\frac{1}{2}$ inch, $\frac{5}{8}$ inch, $\frac{3}{4}$ inch, $\frac{7}{8}$ inch, 1 inch, $1\frac{1}{4}$ inch, $1\frac{1}{2}$ inch, 2 inch and $2\frac{1}{2}$ inch; $\frac{5}{8}$ inch conduit is the size most used in light gauge systems and $\frac{3}{4}$ inch in heavy gauge systems. Gas thread conduit is obtainable and so is oval conduit for runs under plaster.

All classes of conduit are obtainable in enamelled or hot galvanised finishes, the galvanised costing nearly double the price of enamelled in $\frac{3}{4}$ inch welded tube. Zinc-impregnated-rustproof conduit is obtainable in heavy gauge at a somewhat higher price than ordinary galvanised.

Galvanised conduits should be used in all damp situations and where the conduit is in the open air.

Conduit Fittings.—In well designed installations, the conduits are erected first and the cables are threaded through or drawn in afterwards, towards the close of building operations, so that it is necessary to make provision for access to the conduits, and this is done by means of inspection fittings and draw-in boxes. Fig. 4 shows a typical inspection tee with screwed-on lid. Fig. 5 shows a three-way junction box, which may be used for jointing the cables by means of a china interior and terminal blocks, or the joint may be made in the ordinary way and insulated.

Where walls are damp, it is desirable to space the conduits from them and a spacing saddle is illustrated in Fig. 6. Elsewhere the conduits are usually fixed by pipe hooks, or crampets, saddles or clips, or girder clips as required. Wood plugs do not afford a satisfactory fixing on the underside of concrete floors

Fig. 4.—Inspection Tee

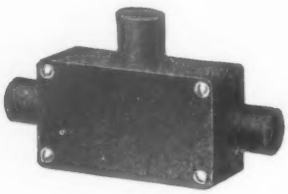

Fig. 5.—Junction Box

Fig. 6.—Spacing Saddle

Fig. 9.—Tee with Screw Continuity

unless they are taper plugs cast in the concrete, and fibre plugs of the Rawl Plug type are the most suitable type. Metal plugs may also be used. Iron boxes carrying fittings should be drilled and screwed to plugs and should not depend for fixing on the conduit saddles.

Where $\frac{3}{4}$ inch conduit has to be concealed under the plaster it is necessary to chase the brickwork unless the plaster is to be very thick.

The lighting switches in concealed installations should be mounted in iron boxes, preferably grid mounted as shown in Fig. 7, so that the switches can be readily adjusted without inserting loose packings to allow for any plastering variations. The outlets from the conduits into all boxes should be either bell-mouthed or fitted with brass or insulating bushes to prevent abrasion of the cables. Where switches are mounted in iron boxes the switches should have earthing bridges, so that the fixing screws earth the metal work of both switch and switch plate. It is sometimes a convenience to arrange a number of main draw-in boxes to act as distribution centres from which cables radiate, and this arrangement is shown in Fig. 8.

In cheap wiring installations no inspection fittings are used, but the fittings and conduits are threaded on to the wires as they are erected. Fig. 9 shows a tee as used in this type of installation, and also shows the set-screw type of continuity joint. The cables are not accessible, of course, in installations of this type, and they are not to be recommended, as any rewiring necessarily involves interference with the building and subsequent making good.

In the early days of conduit wiring, the ends of the lengths of conduit were merely pushed home into the socket fittings without any attempt to obtain continuity, and earthing was useless. This type of installation does not comply with Regulations and should not be permitted. A well designed and executed screwed conduit installation is generally considered to be the best practice in new buildings.

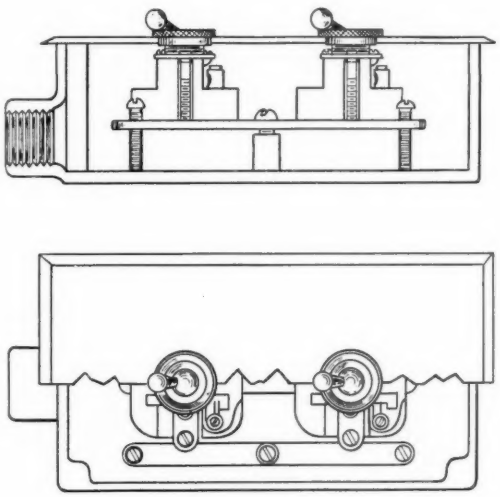

FIG. 7.—GRID MOUNTED SWITCHES

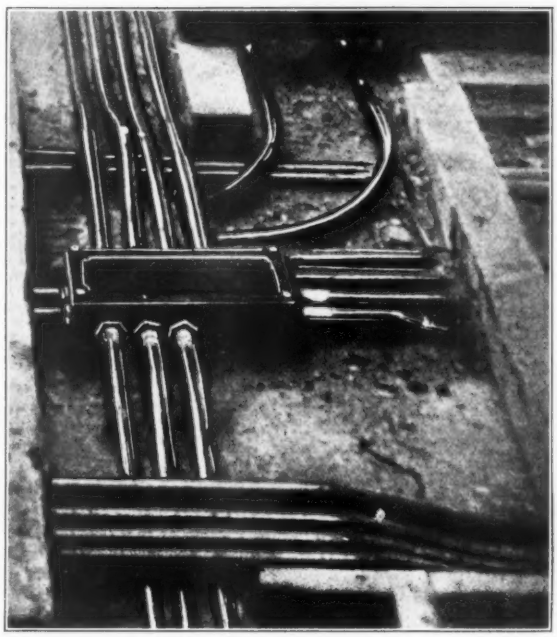

FIG. 8.—DRAW-IN BOX

Cables.—The cables used with conduit wiring systems are usually those known as v.i.r., that is vulcanised india rubber. The conductor consists of 3, 7, 19, 37 or 61 strands of high conductivity tinned copper wire of suitable diameter, insulated with pure rubber next the wire, then two layers of vulcanised rubber, rubber coated tape, hemp braiding and finally waterproofing compound overall. The rubber of a good sample of cable should stretch to five or six times its length without breaking and sharply bending the cable should not visibly damage the insulation or compounding. Single strand wires should not be used as a single wire is liable to be damaged and is not so flexible as stranded cables.

Two main classes of cable are marketed, Association Grade and Nonazo, or Non-Association Class, the former having somewhat better quality rubber insulation and costing appreciably more. Association Cables are made in two Grades, 2,500 Megohm and 600 Megohm, the difference being in the thickness of the insulation. 600 Megohm Grade or Class Cable is all that is usually considered necessary in 200/250 volt domestic installations. Most installations are wired with Nonazo Cables and this Class Cable made by members of the Cable Makers' Association is of really good quality. It is impossible to tell the difference between Grade and Class cables by mere surface inspection, but the tape under the braiding bears the maker's name and classification of the cable.

Cables with tough rubber insulation, without tape or braid, are sometimes used with conduit wiring where condensation is likely to be a trouble.

Lead-alloy sheathed cables used largely for surface wiring are

usually similar in type to ordinary v.i.r., except that they have no braiding, but instead are metal sheathed.

The carrying capacity of a cable is determined by one of two things, either the allowable drop in voltage due to resistance, or the allowable rise in temperature. The voltage drop is the limiting factor in most small cables and the temperature rise in large cables. It is useful to know that with a loading of 1,000 amperes per square inch of cable section, the drop in voltage is 2½ volts per 100 yards run of circuit, or 50 yards point to point. Short lengths of small cable may be loaded to 4,000 amperes without undue rise in temperature, but in domestic work a lower loading, say, about 2,000 amperes per square inch, is more satisfactory.

Cable sizes should be so proportioned that the drop in voltage in any circuit does not exceed 3 per cent. plus 1 volt, or, say, 7 volts in a 200 volt installation. For given wattage and percentage voltage drop, the section of cable required will vary inversely as the square of the voltage, thus a 100 volt installation requires four times the sectional area of copper in cables required with a 200 volt installation.

The sizes of cables are now given in terms of number of strands and diameter thereof, so that 3/·029 means 3 strands each ·029 inch diameter, or a total section of ·002 square inch. This is the cable usually employed for domestic wiring for lighting at 200/250 volts, and will carry 7·8 amperes with a voltage drop of 1 volt per 5 yards point to point.

3/·036, with a sectional area of ·003 square inch and carrying 12 amperes with a similar voltage drop is a better section for use on 100 volt domestic lighting circuits, except where there are only two or three lamps on the circuit.

7/·029, with a sectional area of ·0045 square inch, is largely used for heating sub-circuits to plugs and also for mains, in small lighting installations, between meter and distribution board, and can carry up to 18 amperes.

7/·036, with a sectional area of ·007 is used for the same purposes as the last and is more desirable where voltage drop is to be limited.

7/·044, sectional area ·01 ; 7/·064, sectional area ·0225 and 19/·044, sectional area ·03, are common sizes of cables used for mains in heating installations, between meters and distribution boards.

The sizes are perhaps more easily visualised if it is remembered that ·029 is practically 22 S.W.G., ·036 is equal to 20 S.W.G., ·044 is equal to 18 S.W.G. and ·064 is equal to 16 S.W.G.

(2) Hard Metal Sheathed Cables.—Many of the cable making firms have their own "systems" of wiring with insulated wires which carry their own metallic protection of hard lead-alloy or copper. Most wiring of this type is carried out on the surface with lead-alloy sheathed cables supported about every 10 inch with fixing clips or saddles and the various lengths of cable bonded together with bonding clamps, ensuring continuity of the sheathing. Some systems have an earth wire as an extra core in contact with the sheathing, and with this type of cable the earth wires are twisted together and soldered at the ends of the lengths of cable, and no bonding clamps are used. Joint boxes of various kinds are provided in which to make connections between the current-carrying cores.

When used as a surface system, lead-alloy sheathed cables should be protected with steel channelling where liable to be damaged.

In wiring old houses, the cables may be run under the floors and in conduit under the plaster on walls, care being taken that the ends of the conduit cannot damage the sheathing of the cables. Care must also be taken to see that the cables are not sharply bent, or the sheathing may be cracked.

Copper sheathed cables are also used, with single core cable only, and in cases where there is a private generating plant or where the supply is from alternating current mains through a double-wound transformer, so that there is no electrical contact with the supply system, the sheathing may be used to carry the return current and the system is then a concentric wiring system.

Continuity and earthing are very important points in all metal-covered wiring systems and if not properly attended to, a number of electrostatic and electrolytic troubles may arise.

Some patent plasters attack metal and should not be used to bury conduits or metal covered cables in walls. The gallic acid in new oak has also a deleterious effect and metal-covered cables should not be fixed to it.

One advantage of metal-sheathed wiring systems is that they provide an earth connection at each point.

(3) Tough Rubber Sheathed Cables.—There are several variations of this type of cable used for wiring, principally in old houses and in situations where metal is unsuitable as a protection owing to the presence of excessive moisture, steam, acids, etc. The systems are easily installed but it is somewhat difficult to make a neat job when run on the surface as the cables are "snaky." In one well known system, very small and neat satin walnut grooved capping is used to cover the cables on runs on wall surfaces where it is not desired to redecorate for a time. When redecoration is carried out the cables can then be run through conduits sunk into the plaster.

A drawback with systems of this type is that no provision for earthing is usually made, and where earthing is required, special earth wires have to be run to the points.

Junction boxes of insulating composition are used for junctions between the various lengths of cable.

Some tough rubber-sheathed cables become hard and brittle after a time and the sheathing will crack if bent.

Reliability.—All the wiring systems in general use are reliable if properly carried out and the complaints that are made against them are usually the result of scamped work or the selection of an unsuitable system for the particular installation.

Cost of Wiring

The price per point is apt to be misleading, as it will vary considerably according to the type of installation and type of conduit fittings, accessories, etc., used. It is found that the total costs of labour and material work out approximately in the following proportions: If a welded, screwed conduit system is represented by a figure of 100, then a brazed conduit and grip continuity system of the same class would be represented by about 90, close-joint conduit and grip continuity about 85, lead-alloy sheathed system about 85 and tough rubber sheathed system about 80. Lighting points in welded screwed conduit may cost between 25*s.* and 35*s.* per point in new houses and 15 amp. heating points with interlocking switchplugs and one plug per final sub-circuit will cost 40*s.* to 50*s.* per plug point. Good class bell installations cost about 20*s.* to 25*s.* per point.

The cheaper wiring installations more usually employed in small houses, with close-joint grip continuity conduit, wood boxes for sunk switches and wood cased distribution boards, cost about 14*s.* to 16*s.* per point for lighting points. Heating points with ordinary two-pin plugs and 15 amp. distribution boards cost about 25*s.* as a minimum. If the cables are to be drawn in after the conduits are fixed, as they should be, the cost of the points will be increased by a few shillings to cover the cost of the larger conduit boxes or inspection fittings required.

Lead-alloy and tough rubber insulated systems are usually quoted about the same price as close-joint conduit and cable.

In old houses, the cost is slightly increased by allowances for taking up and reinstating floors and making good, etc., to walls.

The foregoing prices do not include lamps or fittings but are merely for the wiring installations ready to receive fittings.

Flexible Cords

are either v.i.r. or pure rubber insulated, the wires being standardised at ·0076 inch diameter. Pure rubber insulated flexible cords have plain wires and v.i.r. have tinned wires, the tinning being used to keep the sulphur in the vulcanised rubber away from the copper. Flexible cords for pendants, etc., are usually twisted together and are finished with glazed cotton or silk and composed of 23 or 40/·0076. Regulations limit the weight that may be carried by flexible cords and where the fitting or shade is of any considerbale weight it should have chain or other suspension and not depend on the flexible cord for support.

Circular flexible cord is best for portable fittings as it does not kink and is less liable to be damaged than the ordinary twisted kind.

Tough rubber sheathed flexible cord should be used for garage hand lamps, vacuum cleaners, washing machines, etc.

The larger flexible cords used for electric fires, etc., have 70, 110 or 176 strands and should be made up into circular section to comply with I.E.E. Regulation 81.

Accessories

It is not possible here to deal in detail with all the accessories required in modern domestic installations, but they should all be of good quality and design and this is almost assured if they comply with the Home Office Regulations, I.E.E. Regulations and such British Standard Specifications as may apply.

Cut-outs, Fuses and Short-Circuit Values

It is perhaps not generally realised how heavy a current may flow when a short-circuit occurs in a modern distribution system, where all cables are of large sectional area, and where the only limitation to the flow of current may be the resistance of the transformers, mains and wiring. The value of the short-circuit current even in a domestic service may be several thousand amperes and if a fuse fails to break the circuit when a short-circuit occurs, it is inevitable that some damage will be done. It naturally follows that all cut-outs and fuses must be of suitable rupturing capacity if they are to serve their purpose as safety valves in the wiring system. B.S. Specification 88 and I.E.E. Regulation 68 both deal with this point and call for a rupturing capacity of 1,000 amperes for a 10 ampere fuse and 2,000 amperes for a 30 ampere fuse for ordinary duty, and where the short-circuit current could exceed these figures, the fuses must be of the "heavy duty" type, capable of dealing with the short-circuit current wherever it may be.

Ironclad Switches and Fuses

Where the supply undertaking do not provide main switches the consumer must do so, and it is usual to use combined ironclad switches and fuses for this purpose. The usual ratings for switches suitable for domestic work are 15, 30 and 60 amperes at 250 volts for the 15 and 30 amp. sizes and 500 volts for the 60 amp. size. The cases of these combined switches and fuses are so designed that they cannot be opened when the switch is on, nor can the switch be closed with the cover open. The 15 amp. size is suitable for the lighting main switch in a small house and costs about 5*s*., or if fitted with two pairs of fuses so that it may be used as a distribution board where there are no more than 15 to 20 lights, the cost is about 6*s*. 8*d*., and the set is known as a "splitter" switch and fuses.

A 30 amp. switch and fuses costing 10*s*. is illustrated in Fig. 10, and this type is suitable for small heating or power circuit mains and for the control of cookers, etc. A similar switch can be obtained in the "splitter" type. 60 ampere 500 volt switches and fuses cost about 27*s*.

Triple pole switches and fuses are readily obtainable, but have few applications in small house work.

More expensive types of switchgear are used where frequent operation is necessary, as in factories, but are not necessary for small domestic work.

There must always be a main switch near the point where the supply enters a building, whether the supply be from public mains or a private plant, so that all current can be cut off when required.

Distribution Boards

Distributing fuse-boards should be placed as nearly as possible in the centre of the area they supply, the position being accessible and dry. A dry store room, not a larder, in a house is a good position, and the boards should be fixed so that they may not be reached from the floor, but so that the fuses can be replaced when standing on a chair.

It is advisable to have separate distribution boards for lighting and heating circuits, even if the current is not metered separately, as when both supplies are taken from a common board, there is risk of the heavy heating fuses being changed over to the lighter circuits used for lighting. Not only is there this risk, but a 15 amp. board suffices for domestic lighting, whereas the heating circuits should preferably be supplied from boards of 20/30 amperes capacity.

With screwed conduit installations, the distribution boards are iron cased, but with the other types of installation they are mostly teak cased. Where the conduit is concealed under the plaster, the ends can either be brought out to the surface and "set" so that they enter the board, or special glands can be obtained to fit the top of the board so that no bending or setting is required.

The cover of the distribution board should have a schedule of the circuits supplied and the correct size of fuse pasted inside it and spare fuse wire should be kept inside the board.

A 15 amp. 250 volt ironclad distribution board having six ways, costing 17*s*. 8*d*. and suitable for lighting circuits is shown in Fig. 11, and it will be noted that the lower bank of fuses is tilted for easy wiring, the dividing partition between the two banks having been removed temporarily to show the tilting movement. All iron cases should be generous in size in order easily to accommodate the cables.

The number of lights per way should not exceed 10, the wattage 600 or amperes 6, and one or other of these limitations will settle the number of ways required on each distribution board. It is wise to leave a spare way or two where extensions are at all likely at a future date. It is also wise to make the mains between the distribution board and the main switch or main distribution board, as the case may be, large enough to carry the whole load, although probably never more than $\frac{3}{4}$ or $\frac{3}{4}$ of the lights will be in use at the same time. For the board illustrated, 7/·036 mains would be quite suitable in a house lighting installation. The board used as above would technically be a "sub-distribution" board and the circuits taken from it to the lighting points would be "final sub-circuits" in the terminology of the Regulations.

It is wise to insist on connections being made in a definite way and the old rule "Leads low, returns raised, leads left, returns right," may well be followed. This means that the lower bank of fuses on a double-pole distribution board is the live or phase wire and the upper is the return or neutral. At

a switch point, the left should be the live side and the right the return or negative or neutral according to the particular circuit. In single pole lighting switches, the feed from the lower fuse on the distribution board should be brought into the left terminal of the switch.

The larger 30 ampere four-way distribution board shown in Fig. 12 is very suitable for supplying heating circuits. The I.E.E. Regulation 95 permits two points to be supplied from a final sub-circuit where the current does not exceed 20 amperes, and this means that in wiring heater plugs, two plugs are often wired in parallel on the same sub-circuit, usually with 7/·036 cables to the first plug, looped out with 7/·029 or 3/·036 to the second plug. This presumes a limit of 10 amperes per plug, but 3 kW heaters are now common and take 12 to 15 amperes at the usual voltages of 200/250, so that it is very desirable to have only one plug point per sub-circuit, otherwise a circuit may be carrying 25/30 amperes, necessitating a fuse to blow at about 50 amperes. A fuse of this size is not desirable in a domestic final sub-circuit, as the flash that may occur, say, at a plug point when a fault develops is alarming if nothing worse.

The number of ways required on a heating circuit sub-distribution board should therefore usually be the number of points to be fed, and it must not be forgotten that the heating may have to be split up into two or three main circuits in order to reduce the out of balance current which would arise if the whole load was put on one phase of a three-phase supply or on one side of a three-wire single phase or direct current supply.

The cost of the board illustrated in Fig. 12 is 29*s*. 4*d*., and similar boards are obtainable in 2 to 10 ways. Most makers list boards up to 10 or 12 ways, and for larger installations two or more boards may be used, but will not usually be required close together as it is more economical to place them as near their work as possible than to group them at one point.

Distribution boards will probably go out of general use within the next few years and their place will be taken by magnetically operated circuit-breakers, which have several advantages over fuses, but which are somewhat more expensive at present.

Lighting Switches, or Branch Switches

Most switches used for this purpose are of the "tumbler" variety, either surface, semi-sunk or sunk types, rated at 5 amperes. The general form of the switch is well known and it is almost universally used in this country. The older forms of tumbler switch could be opened and closed, *i.e.*, switched off and on slowly, and this gave rise to burning at the contacts if they were so used, particularly with relatively high wattage gasfilled lamps, which take about 10 times the normal current at the moment the switch is closed owing to the low resistance of the lamp when cold. The newer type of quick make and break switch overcomes this difficulty and places the actual making and breaking of the contact outside the operator's control, although the switch still has a positive action and does not depend solely upon springs for its correct operation. Whilst these switches prevent arcing and improper operation they are often somewhat noisy, and the operation of any switch is heard all over a house, and for this reason care should be taken in selecting switches for domestic use.

In the principal rooms of a house the switches are usually sunk flush with the wall face, the dollies only projecting, and the switches are covered with metal plates. The metal plate must be earthed where there is any risk of shock to the user if the plate or dolly becomes alive, and this is provided for automatically where iron boxes are used and the switches are provided with earthing bridges, as the fixing screws connect the metal dolly, and indirectly the plate, to the conduit system. All-insulated switches of both the surface and sunk pattern are much used and are compulsory where the floors are other than joists and boards and it is not proposed to earth all metalwork. In a tiled floor kitchen, for example, the switches must either be insulated or earthed.

Sunk or flush switches are very neat, but an objection sometimes raised to them is that the wall becomes dirty round the switch plate owing to folk groping for the switch in the dark. Where this objection is raised, the switches may be semi-sunk, that is, half recessed into a hardwood block, or they may be of the ordinary surface pattern with a $\frac{1}{2}$ in. or 1 in. thick hardwood block in the less important rooms.

Two-way switches are very convenient for the control of corridor and bedroom lights from either of two points, and by the addition of "intermediate" switches the control may be extended to any number of switch points, two of the switches being ordinary two-way switches and the remainder "intermediate" type.

Pressel or hanging switches, for use over beds, etc., are not so much used, perhaps, as formerly, because a special cord operated ceiling switch is better in some respects, a pull on the cord switching the light on or off as required. Ordinary wall switches are to be preferred to either ceiling or pressel switches where they can conveniently be reached from the bed. Two-way switching in bedrooms where there is only one lamp should always be arranged so that one may get into bed with the light on and switch off afterwards.

Plugs and Switch-Plugs

Plug points or "outlets," are necessary for supplying portable apparatus, and it is still the custom in many localities to use two-pin plugs and sockets without switches and with no protection to the live sockets when the plug head is not in place. This is permitted by regulations where there are not more than two plugs in one room, but is undesirable, as children may poke metal articles into the sockets and receive fatal shocks, and, where the portable apparatus is not fitted with a switch, the circuit has to be broken by the plug and this results in sparking and bad contacts, which result in overheating in the sockets later. If no switches are fitted, the sockets should be of the "anti-flash" type, in which insulating blocks close over the sockets immediately the plug is withdrawn. Some plugs have a third pin which operates a switch in the socket, making contact with the switch movement after the current-carrying pins have entered the sockets and breaking the circuit again before the plug is completely withdrawn. The third pin also serves for earthing.

It is very desirable at the present time to install three-pin plugs with proper provision for earthing in most new houses, as the use of earthed portable apparatus will probably be compulsory in the future.

Interlocking switch plugs have much to recommend them in some installations, where they are not liable to particularly rough usage, and offer good protection from shocks. The plug is a three-pin plug as illustrated in Fig. 13, the third pin serves for earthing and serves as a locking device as well. When the plug is out the switch cannot be operated, and the plug cannot be withdrawn with the switch on. The price with sunk iron box and B.M.A. finish front plate is 13*s*. 4*d*. Capacity 15 amps. B.S. rating. Five ampere plugs of the same type cost 8*s*. 4*d*. each.

Switch plugs fitted with anti-flash sockets, but not interlocked, are an alternative to the interlocking type, being slightly

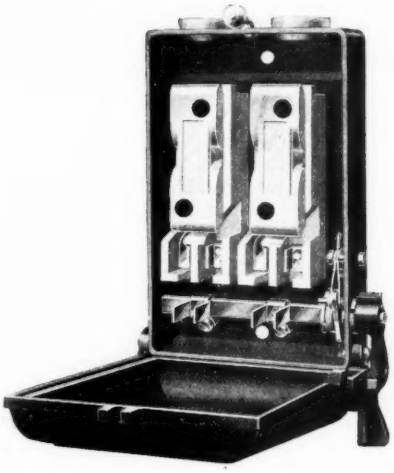

FIG. 10.—IRONCLAD SWITCH AND FUSES

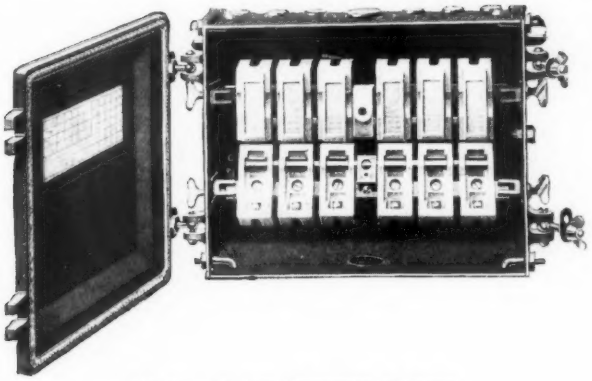

FIG. 11.—15-AMP. DISTRIBUTION BOARD

FIG. 13.—INTERLOCKED SWITCH-PLUG

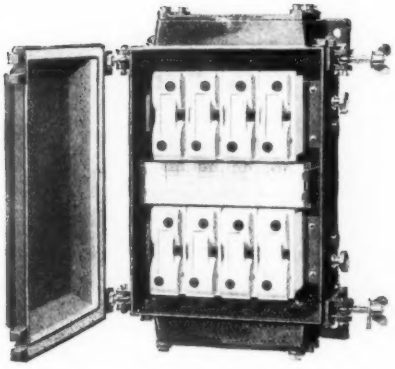

FIG. 12.—30-AMP. DISTRIBUTION BOARD

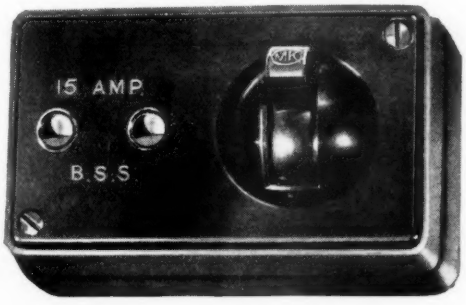

FIG. 14.—ANTI-FLASH SWITCH-PLUG

FIG. 15.—SAFETY PLUG

cheaper and perhaps in some ways more robust under rough usage ; Fig. 14 shows the anti-flash type.

Switch-plugs can be obtained in surface, semi-sunk and sunk patterns, and the 15 ampere size should be standardised for heating circuits with the larger radiators and 5 ampere size for lighting and small heating circuits within their capacity. Smaller plugs of 2 ampere capacity are available and are suitable for clock circuits, wireless loudspeaker extensions, and table or standard lamps, etc., particularly where 5 and 15 ampere plugs are used for heating circuits and the charge for lighting current is at a higher rate than that for heating. Lighting appliances may not be supplied from heating circuits where differential rates are charged for the current.

It is often a convenience to be able to take a second circuit from a heater plug point, and to do this with safety, special plugs containing a small fuse may be obtained to take the place of the regular 15 amp. plug, a 5 amp. plug being inserted into the top of the 15 amp. when the extra circuit is in use. Fig. 15 shows this auxiliary safety plug.

Plug points are usually fixed in or on the skirting, as being the most convenient place, but it is sometimes a convenience to have them mounted about 3 ft. above the floor level. In some cases the plug is in the skirting and a separate switch is fixed at about 3 ft. above it to obviate bending to switch on or off. In a bedroom, the heater plug may sometimes be controlled from the bedside with advantage.

Insulating compositions of the Bakelite class are much used in the construction of plugs and sockets and switch-plugs, the bases usually being of porcelain with composition covers and plug tops.

A new type of switch-plug combines a switch and plug with a miniature circuit breaker, not interlocked, but arranged to trip the circuit breaker before the plug is completely withdrawn. The advantage of this combination is that the circuit breaker is quicker in action than a fuse, and can be immediately switched on again after a fault has occurred and been cleared, and, naturally, no fuse has to be replaced.

Ceiling Roses of China or Moulded Composition or combinations of both are commonly used to make the connection between the circuit wires and the flexible cords leading to lamps or other fittings, and should comply with B.S. Specification No. 67 and I.E.E. Regulation No. 107. Not more than two pairs of flexible cords may be taken from any ceiling rose unless it is specially designed for the purpose. Ceiling plates are generally preferred to roses in the more important rooms, china connectors being used inside the ceiling plate or in a conduit box under the floor to make the connection between flexible cord and circuit wires. A ceiling rose fixed in, or under, the floor is really the best method of making this connection, and costs only about 10*d*.

In damp situations special ceiling roses filled with sealing compound should be used to prevent the access of moisture to the wires, and the flexible wires should be hard rubber sheathed and not the usual braided type.

LAMPHOLDERS

The standard type of lampholder for lamps up to 100 watts in this country is the bayonet cap, with two spring plungers conveying the current to the lamp cap contacts. The lampholder may be of brass or aluminium with a china interior, or may be moulded composition. Lampholders wholly of china, except the plungers and terminals, may be obtained for use in specially damp positions.

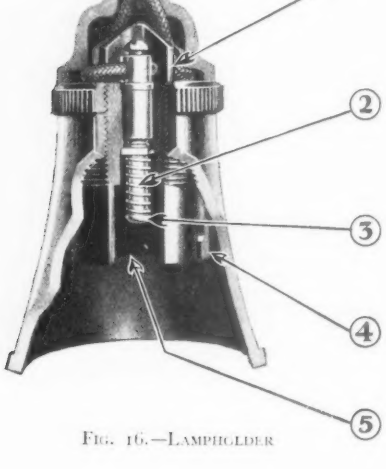

Fig. 16.—Lampholder

The lampholder may have a key-switch to give control of the lamp individually, but must also be controlled by a wall switch, and lampholders may have shade rings to carry shades, and if intended for use with a flexible cord suspension must have a proper cord grip to relieve the terminals of the weight of the pendant. Other types are screwed for attaching to fittings, etc.

The usual type of plunger has a spring enclosed in the hollow of the plunger to make certain contact with the lamp contacts, but when used for relatively heavy current and with gasfilled lamps, these springs lose their elasticity after a time, and therefore a better method of construction is that shown in Fig. 16, in which the plungers are solid and the springs on the outside of them.

Lampholders in bathrooms and other rooms having hard floors must be either earthed or made of insulating material.

Lampholder adapters are frequently used for taking current from a lampholder for irons, toasters, vacuum cleaners and other small domestic appliances. Regulations limit the current to be taken to 2 amperes, and this rules out the use of a lampholder for a 500 watt iron on a 200 volt circuit; but, of course, we know that they are often used from lampholders, and work quite well with the solid plunger type of lampholder, but not with the older type.

Edison screw lampholders are used in this country for lamps of 150 and 200 watts rating according to Regulations, but lamps with bayonet caps are stocked in these sizes for 200/250 volts.

The Edison screw lampholder has a centre contact, and the screwed portion makes contact with the screwed lamp cap to form the second pole. It is important that where one conductor, or pole, is earthed, the live conductor be connected to the centre contact, as the lamp cap will otherwise be live and

dangerous to touch. Edison screw lampholders are standard for general use, except for the largest lamps, in many countries. Goliath lampholders, a larger edition of the Edison screw, are used for lamps of 300 watts and upwards, but do not find many applications in domestic work, except where current is cheap and the light provided by a 300 watt lamp is considered necessary. B.S. Specifications 52 and 98 deal with B.C. and Goliath lampholders.

The best ordinary qualities of lampholders of the B.C. type cost 1*s.* to 1*s.* 3*d.* each.

LIGHTING

The average house requires artificial lighting for between 1,500 and 2,000 hours per annum, and the lighting installation should provide adequate light free from glare. Domestic lighting cannot usually be worked out with the precision that is possible in industrial installations using scientifically designed reflectors, but fairly accurate approximations can be made as a result of previous experience with any particular system of lighting.

The general tendency to-day is to increase the standard of illumination and to obscure all light sources, either by enclosing them in translucent glassware or completely concealing them in cornices, etc., and to use only the reflected light from the ceilings. Colour may be introduced into domestic lighting with satisfactory results, particularly in entrance halls and lounges. It should be borne in mind that any form of bowl fitting which is open at the top will collect a considerable amount of dust, dead flies, etc., and need fairly frequent cleaning, and also that some of the modern fittings which are made up of glass panels with very light metal work require dissembling for cleaning, and breakages are likely during the process unless considerable care is exercised. Where installation and maintenance costs are important, it is desirable to use fittings designed to take standard type lamps, and it is also desirable to minimise the number of types or sizes of lamps used in order that a small stock of lamps for replacement may be carried. Six sizes of "Pearl" or inside frosted lamps are standardised for domestic use, the ratings and prices being as follows: 15 watt 2*s.* each, 25, 40 and 60 watts 1*s.* 9*d.* each, 75 and 100 watts, 2*s.* 6*d.* each. All these lamps, with the exception of the first two sizes, are gasfilled, and all burn for upwards of 1,000 hours. Lamps of 150, 200, and 300 watts rating are occasionally used in domestic work, usually with bowl fittings.

The scheme of decoration has a considerable influence on the real and apparent illumination, as there is little reflection from dark surfaces, and where the walls are of dark colour, the ceilings must not be too brightly illuminated, or a soot and whitewash effect will be produced.

The intensity of illumination in any type of lighting installation may readily be ascertained by the use of a portable photometer or light-meter, calibrated to give direct readings in foot-candles. These instruments work on the well-known grease-spot principle, and are very simple to use. The cost is £5 5*s.* to £15 15*s.*, according to the type of instrument and the nature of the equipment.

The Entrance Hall creates a first impression upon the visitor, of depression if dimly lit or cheerfulness if suitably lit. In a well-lit hall the light is softly brilliant without harsh shadows. A light near the door is desirable, and if the hall is not compact, further pendant or bracket points may be required. Two-way switches are usually provided, to give control from ground and first floors, and the lamps used are usually 40 or 60 watts. The intensity of illumination in an entrance hall should usually be between 1 and 3 foot-candles.

Dining Room lighting is of a special character to the extent that the table is the most important item to consider, but the sideboard or service tables must not be overlooked, and must be efficiently lit.

The object to be attained is a good light on the table, with the rest of the room more dimly lighted, and rise and fall silk shade fittings with, say, three 40 watt lamps, are usually successful. Some fittings have an additional 100 watt lamp projecting light on to the ceiling, and this lamp is switched off during meals.

Bracket points with glass panel type brackets, or candle lamps with vellum shades may often be suitably employed for additional illumination and the introduction of colour into the scheme. Table and standard lamps are useful, particularly if the room is also used for reading.

The intensity of illumination should be 4 to 6 foot-candles.

The Drawing Room or Lounge should be softly and evenly lit, the intensity of illumination being 3 to 4 foot-candles. Standard and table lamps are again useful.

The Kitchen is the workshop of the house, and should be illuminated to an intensity of at least 4 foot-candles. An enclosed fitting in white enamel and opalescent glass is usually most suitable, with a 100 watt lamp, and is illustrated in Fig. 17. the cost being 13*s.* 6*d.* The light position is usually arranged in the centre and over the table, but a better position, where

Fig. 17.—Kitchen Light Fitting

possible, is about three feet in front of a worker standing at the table. The light should also be so arranged that it will shine into the oven and also into any cupboards there may be.

The Scullery should be similarly lighted to the kitchen, but with a lamp of lower power, and the light position should

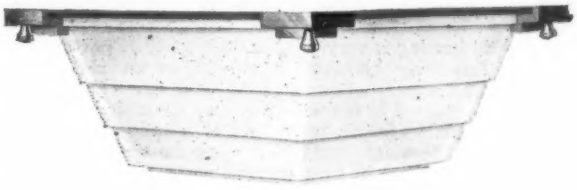

Fig. 18.—Lighting Fitting

be such that the worker at the sink is not in her own light. A fitting similar to that suggested for the kitchen would cost about 10*s*. 6*d*., the glassware being rather smaller.

THE LANDING should be illuminated to at least 1 foot-candle, and a ceiling light similar to Fig. 18, and costing £3 15*s*., is suitable, as it is out of the way of broom handles, etc. Two-way

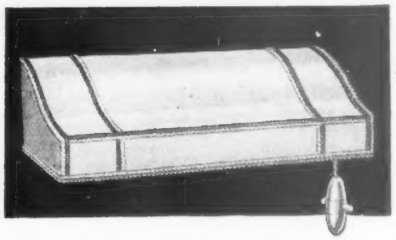

FIG. 19.—LITLUX BED OR MIRROR LIGHT

switch control should be provided, and if there is a second floor, two-way and intermediate control from each floor should be arranged.

THE BEDROOMS require a general illumination of about 1 to 2 foot-candles, with 4 to 6 foot-candles on the dressing table. A central pendant point with a 60 or 75 watt lamp and large

FIG. 20.—LIGHTING FITTING

tinted glass or vellum shade will usually meet the case, the cost of the fitting being about 13*s*. 6*d*. Bowl type fittings are sometimes used in bedrooms, but collect dust. The dressing table may have candle type fittings carried on the pillars supporting the mirror or a special mirror light of the type illustrated in Fig. 19, and costing from 16*s*. each, may be used. A plug point is necessary for either of these fittings, of course, and should preferably be within easy reach and not in the skirting.

A bed light similar to the mirror light is a convenience, and as an alternative one may have a table lamp alongside the bed, the plug being fixed so that it may be reached from the bed.

If lavatory basins are provided in bedrooms, they should have a local bracket light.

THE BATHROOM requires a general light from an enclosed fitting with a 40 or 60 watt lamp, with a bracket light over the lavatory basin. White enamel and chromium-plate finishes are usual, and Fig. 20 shows a general lighting fitting in chromium plate costing 15*s*. A shaving mirror with light combined may be provided at a cost of 33*s*. 6*d*., and is illustrated in Fig. 21. A plug point is required for this mirror. A heated towel rail may be provided at a cost of £2 17*s*. 6*d*.

FIG. 21.—SHAVING MIRROR

W.C.'s may have enclosed fittings similar to bathrooms, or an ordinary fancy glass shade costing only a few shillings.

The other domestic offices are usually simply fitted with opal or glass shades and suitable pearl lamps.

BOILER ROOMS should have the light position arranged to illuminate the front of the boiler or boilers and also the fuel heap, and enamelled iron shades are most suitable in these positions.

THE GARAGE should have one or two points for general lighting, with a rise and fall fitting over the bench if one is provided. A plug point and hand lamp is essential, and the same point may be used for a small heater for winter use if current for all purposes is supplied at a common charge. Enamelled iron shades are the most satisfactory in a garage if a cheap installation is desired, otherwise enclosed fittings similar to Fig. 20 are suggested.

OUTSIDE LIGHTS. It is often an advantage to have lighting points outside the entrances and at intervals along drives, etc. Lamps of less than 60 watts rating do not produce much effect in outside lighting and are not desirable. The fittings used should be weatherproof, and the wiring to them, if laid underground, should be carried out as suggested for services to outbuildings.

It is always desirable to label the switches controlling outside lights, as the light may not always be seen from the switch position. Ivorine labels are useful for this purpose and are inexpensive.

HEATING, COOKING AND REFRIGERATION, ETC.

ELECTRIC HEATING

Electric heating is very popular in the home, particularly the maidless home, because of its convenience and cleanliness.

The actual amount of current required to heat a given room can be ascertained in the same way that one would work out the same problem for any other form of heating—that is, find the B.Th.U.'s required per hour to heat the air changes and make good the loss of heat through walls, windows, doors, floors and ceilings. When the total B.Th.U.'s have been obtained, the answer should be divided by 3,410, as this is the number of B.Th.U.'s in a unit or kWh of electrical energy. The answer is, of course, in kWh required, and apparatus of this size should be provided.

A more simple and approximate method is to allow 1 watt per cubic foot of space to be heated. It is best to allow 50 per cent. extra heating power where the room is to be heated up quickly, and as little as ½ watt per cubic foot will give satis-

factory results in buildings which offer good thermal insulation and where the heating is continuous day and night. Not many houses are continuously heated by electricity except where water power is available.

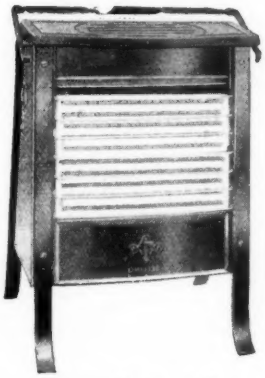

FIG. 22.—ELECTRIC FIRE

In cases where a room requires more than 3 kW of heaters it is best to use, say, one heater of 3 kW and provide the remaining heat from other points, probably tubular heaters.

The principal types of heating appliances are:—

Bowl Fires fitted with pedestals and burnished copper reflectors. The element is at the point of focus of the bowl, and takes 600 or 1,000 watts according to size. The cost is from 12*s.* 6*d.* to 30*s.* Bowl fires are very efficient heat projectors, but are not intended as air heaters. A 5 amp. switchplug is the best means of supplying a bowl fire, and they should not be supplied from lampholders, as is often done. If used in a bathroom the metalwork of the fire should be earthed, and it should preferably be mounted on a bracket with a very short length of flexible cord so that it cannot be moved near the bath or lavatory basin.

Bar Fires. The majority of the fires used for room heating have fireclay firebars with nichrome resistance spirals working at a rather dull red heat. The best firebars are scientifically designed, and up to 70 per cent. of the heat given off is radiant heat. The spirals should run in grooves and be secured by light metal clips at the ends and centre of each length of spiral. Each firebar is usually rated at 1,000 watts.

The metalwork of a fire may be sheet metal or cast iron, the finish in the latter case being black, armour bright or vitreous enamel. Fig. 22 illustrates a sheet metal fire rated at 2 kW, and costing 36*s.* This pattern is very useful for bedrooms and small rooms where cost is a consideration, and has the advantage that the fire is elevated and does not overheat the floor near it, as some of the lower types are liable to do.

Fig. 23 shows a 2 kW fire of "Adam" design in armour bright, suitable for a living room, the cost of this fire being £4 12*s.*

It will be noticed that two-bar fires have one switch and 3-bar fires two switches, the switches each controlling one bar and the remaining bar being connected direct across the terminals of the fire. This arrangement is made so that to switch the fire off one must switch off at the switchplug, or if there is no switch to the plug, the plug must be pulled out to break the circuit, and thus the flexible cord is not left live when the fire is off.

Imitation coal fires and log fires have glass or other composition "fuel," and the flickering effect is produced by a 40 watt lamp with a revolving disc above it. The actual heat is produced by the ordinary type of firebar. These fires are very popular, and cost anything from about £3 15*s.* to £15 or more. Built-in fires and fires to fit in coal grates are available in many types.

Fifteen amp. B.S. gauge switchplugs should be provided for all the foregoing fires, except where they are rigidly fixed, in which case the circuit wiring may in some cases be taken to the fire and a switch only is then needed to control it.

In bathrooms a fixed fire screwed to the wall is the best, and the circuit wiring may be taken up to it in conduit, a separate switch being provided for control. The fire must be earthed in bathrooms or any other place which is moist or has a hard floor.

Tubular Heaters are very useful for halls, corridors, under windows, nurseries, living-rooms, etc. The tubes are about 2 in. diameter, or may be oval section, and the rating is 60 watts per foot run. The surface temperature varies from 110 to 136° F. according to the type of tube. The oval section has the lower surface temperature. The tubes advance in foot lengths from 2 ft. to 17 ft., the cheaper type costing 12*s.* for the first 2 ft. and 3*s.* per foot thereafter. Fig. 24 shows a tubular heater of somewhat higher cost than the above.

Thermostatic control is often arranged, the air thermostat costing from about 38*s.*, one being required for each room. "Comfort" thermostats are more expensive, and consist of a desk instrument which has a ball registering heat or cold, just as a human being would do, and controlling the heat through a relay.

It is desirable that the wiring should be brought right up to the heaters, switches only being provided for control, but the supply is more usually taken from plugs or switchplugs.

FIG. 23.—ELECTRIC FIRE

FIG. 24.—TUBULAR HEATER

Where a number of tubular heaters are installed it is better to provide a separate 15 ampere distribution board for them than to supply them through a 30 ampere board used for the larger bar fires.

Panel Heating by electricity is possible, the panels consisting of fine resistance wire embedded in insulating material in sheet form, covered over with scrim cloth and plastered over.

Hot Water Radiators of the standard low pressure type can be fitted with electric immersion heaters of the type illustrated

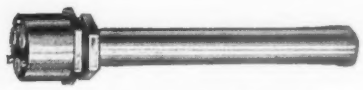

FIG. 25.—IMMERSION HEATER

in Fig. 25, which are screwed into the bottom connection, the top connection being fitted with a filling plug and vent.

THE COST OF ELECTRIC HEATING

The cost of electrical heating is difficult to estimate in a house because of the varying conditions of use, but it is perhaps interesting to note that in an observed installation which, prior to the end of 1925, used gas fires for heating, except for the kitchen fire and a bathroom electric radiator, and where the cost of lighting current was 4*d*. per unit and heating current 1*d*. per unit, gas costing 2*s*. 9*d*. per 1,000 c. ft., the combined cost of gas and electricity in 1925 was approximately £32.

The installation was changed over to electric heating and lighting, gas being retained for cooking and a wash boiler, and the costs in the first year were £30. Since that date the annual costs have varied slightly, but for the year to March 1932 were less than £29, and the gas consumed was 46,100 c. ft. and the electricity 8,724 units. Electricity is supplied on a two-part tariff with a fixed charge of £4, being one-twelfth

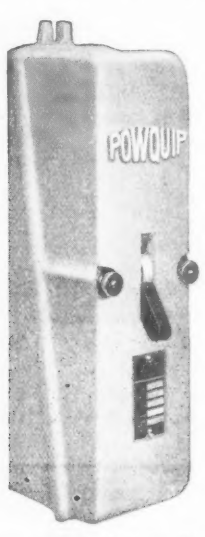

FIG. 26.—50-AMP. CIRCUIT BREAKER

FIG. 27.—MINIATURE CIRCUIT BREAKER

of the net rateable value, plus ½*d*. per unit. The consumer is satisfied that there is little difference in the costs of gas and electricity in this particular case. No apparatus has failed to function, and none of the hot wire firebars have burnt out, although some of them have done over 10,000 hours run. The end of one spiral of the fire most used has burnt off three times in over six years owing to a bad contact, and one switch has had to be replaced. The apparatus used has a collective loading of 20 kW, of which 2 kW is lighting, so there has been remarkable immunity from trouble.

Future Heating Circuits in small houses will probably be installed quite differently from the present distribution board method, and may comprise one or more ring mains of about 7·044 cable protected by single-pole circuit breakers of 50/60 amp. capacity, as illustrated in Fig. 26, and supplying 6 to 8 heater points, at each of which there would be a miniature circuit breaker combined with a plug, or separate from the plug. Fig. 27 shows a circuit breaker suitable for the purpose and costing 10*s*. 4*d*. The method of installation suggested would simplify installations, and where the neutral is solidly and well earthed there seems to be little objection to it, although it is not approved practice at present.

WATER HEATING

A plentiful supply of hot water is a convenience in any household, and can be provided electrically with the greatest ease, although the fuel cost may be more than that for a coke boiler or range boiler. The amount of hot water used will vary very greatly, but 25 to 50 gallons per day will satisfy most small families if the temperature is at least 160° F.

The geyser type of water heater is not suitable for domestic use generally, as it needs to be rated at about 12 kW to provide hot water for baths quickly. Probably the most convenient system is that usually provided in houses, but with the cylinder electrically heated. The cylinder may probably be 20 to 30 gallons capacity, loaded to 1 or 2 kW, and costing about £13 to £16. These cylinders, or water heaters, are beautifully made and finished, and are very efficiently lagged with granulated cork. The annual current consumption may probably be between 3,000 and 5,000 kWh, according to use. A very useful alternative is the immersion heater in an ordinary cylinder, which may also be heated by a range boiler or independent

boiler. The cost of the heater, say 2 kW size, complete with three-heat switch giving ·5, 1 and 2 kW heats, is under £3. The cylinder should be lagged to retain the heat.

Thermostatic control is usually provided with the better class of water heaters, so that the temperature is maintained at about 190° F., the current being turned on and off as required to maintain the temperature quite automatically.

About 400 to 500 watts should provide the required amount of hot water if left on continuously night and day.

Specially low rates are sometimes charged for current supplied during the night only for water heating, say about ½*d.* or ¾*d.* per kWh, and relatively large storage heaters are then employed to provide the supply of hot water during the day. Clock switches are employed to switch the current off during restricted hours, but a new idea for controlling these circuits is to provide control gear operated by high frequency currents at about 700 cycles, the high frequency current being superimposed on the ordinary supply mains. The advantage of this to the supply undertaking is that they are able to throw off an unwanted load at times of sudden darkness or in other emergencies. The same idea will probably be used to control street lighting in the future.

Small thermostatically controlled water heaters are sometimes fitted individually over sinks and lavatory basins where a piped system of hot water supply is not desired.

All electrically heated hot water apparatus should be earthed to prevent the possibility of shocks.

The heating elements used are generally very reliable and last a long time. In the best types of apparatus, the interior of the heating element can be removed for inspection or repair without breaking any water joints or running the water off.

Fig. 25 shows a typical immersion heater for insertion in a cylinder or tank.

Electric Wash Boilers, similar in form to the familiar gas boiler, cost about £5 5*s.* in the 10 gallon size with tinned copper interior, and take about 3,500 watts. A spraying device may be obtained for these boilers, which permits a boiler full of clothes to be washed with 2½ to 3 gallons of water, with resulting economy in current and relatively quick heating up from cold.

Electric Cooking

The British Standard Cooker has been produced co-operatively by nine firms in this country in order to permit of mass production and easy replacement of parts when required. Two sizes are available, rated for 6 and 8 persons respectively. Non-standard cookers are made by many firms. Cookers are made in both vertical and horizontal types, the former following the old gas cooker design. The horizontal type takes up more wall space, but as both the oven and boiling plates are at table height they are much more accessible than in the other type, in which the oven may be too low and the top cooker too high. The ovens themselves are loaded to 2 to 3 kW, according to size, and the total loading of a cooker is usually between 6 and 8 kW.

The wiring is very often run straight from a meter, a 30 ampere ironclad switch and fuses being provided both at the supply end and near the cooker. The latter switch often has provision for supplying a kettle, a switch, fuse and plug being included in the switch case. The cable used for wiring cookers on 200/250 volts is usually 7/·044.

Domestic cookers cost from £8 to £25 or more, according to the size and equipment, £15 being an approximate figure for a medium size.

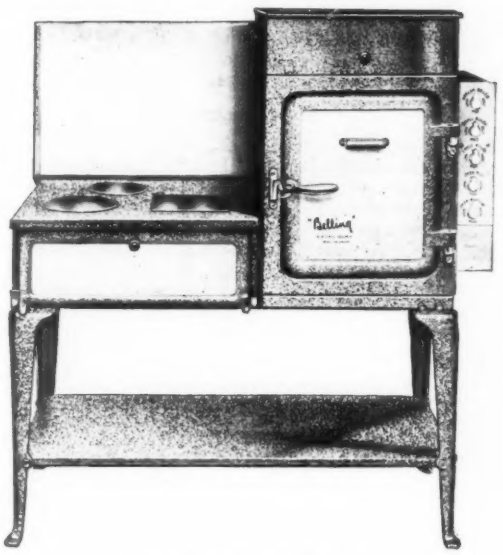

Fig. 28.—Electric Cooker

The amount of current used will naturally vary with the cooking done, but a test showed an annual consumption of a little over 1,000 kWh per annum for a family of two persons and a small child.

An electric kettle with a capacity of, say, 3 pints, taking 975 watts and costing about 36*s.* should be provided with all electric cookers, as the kettle will boil water with about 40 per cent. of the current used in boiling an ordinary kettle on one of the cooker boiling plates. Utensils used on enclosed type electric boiling plates should be flat bottomed or there is a considerable wastage of heat.

An electric oven is economical where current costs not more than 1*d.* per unit, or kWh.

Small cookerettes costing about £5 are useful for two people in a small house.

Fig. 28 illustrates a useful type of electric cooker for a family of 6 or 8 persons, and costs £19 12*s.* 6*d.* The oven takes 2,600 watts full on and provides a cooking space 14½ in. × 14½ in. × 14½ in. The boiler-griller takes 2,250 watts, the larger boiling plate 1,200 watts and the smaller 900 watts, a total loading of 6,950 watts. Three heat control giving ¼, ½ and full heat is provided for each element.

Smaller cookers of the same type cost £13 10*s.* and £16 7*s.* 6*d.* and vertical types cost roughly £4 less for the same sizes.

Cookers are very often hired from the supply undertaking at quarterly rentals of 7*s.* 6*d.* to 12*s.* 6*d.*, according to size.

Table Cookery.—Various electrically-heated small appliances such as toasters, warming plates, water jugs, coffee percolators, etc., are a convenience and plug points should be provided for them in a dining room. The current consumption of these small appliances is not usually more than 300 to 600 watts.

Country House Cooking.—Small private lighting plants are not able to supply sufficient current for cooking purposes, but may be useful in providing power to drive a petrol-air gas generator which will supply a gas cooker. The cost of a suitable gas

generator is about £21, complete with electric motor taking about 50 watts. The gas produced has a calorific value of 248 B.Th.U. per c. ft., and a gallon of special gas making petrol will produce about 600 c. ft. of gas.

Refrigerators

At temperatures above 50° F., food deteriorates rapidly owing to the multiplication of bacteria, and the omission of cellars in modern domestic architecture makes it very desirable that refrigerators be provided for the storage of perishable food during a large portion of the year. The modern domestic refrigerator is a very attractive piece of equipment costing from about £20 upwards, and, being operated automatically by a thermostat, needs little attention.

Various methods are adopted to produce the required low temperature in the refrigerator, some types having a motor driven compressor and others being motorless. Some require water for cooling purposes and others use air cooling, the running time per day varying from about 6 to 10 hours. Domestic refrigerators usually take 200 to 300 watts per hour, whether fitted with a motor or not, the annual current consumption being between 300 and 1,000 kWh, depending on the use made of the equipment and the amount of ice drawn from the ice box.

The refrigerant is usually either sulphur-dioxide or ammonia, the latter being hermetically sealed, so that there is no smell.

It is important that the food should not be frozen, as in the thawing process food tissues deteriorate, and it is equally important that the air inside the cabinet be dry, otherwise there may be trouble with fungoid growths.

The only provision in the wiring system for a refrigerator need be a 5/15 amp. switch and fuses, or a switchplug, provision being made for earthing the metal of the refrigerator. The refrigerator should of course be connected to the power supply and not to the lighting distribution board, where higher rates are charged for lighting current.

Washing Machines

Washing machines are available in various types from about £15 upwards, but most of the better types cost £30 to £50, according to size and type. The driving motors are usually about ¼ h.p., either direct current or single phase alternating current, and may be supplied through a switchplug with provision for earthing. Some washing machines have a water heater of 2 to 3 kW built into them, and when this is so, the wiring should be the same as for a heater or radiator plug point, at least 7/·029 cable and a 15 amp. switchplug, or a 15 amp. ironclad switch and fuses if desired, with provision for earthing. The more expensive types of washing machine include a wringer with rubber covered rollers.

Pumps

In the country house water has often to be pumped, and this can be done quite cheaply and automatically by an electrically-driven pump with a ¼ h.p. motor, which will pump up to about 260 gallons of water per hour with a total suction and lift up to 80 feet. The motor may be controlled by a float switch in the tank, so that it is started when the level of the water falls to a certain point and stops when the tank is full. The motor would also be controlled by a double pole ironclad switch and fuses, the wiring being 3/·029 or 3/·036 and supplied from the power distribution board of course. A small private house lighting set is capable of operating a pump of this class. The cost of the pump and motor complete is from £13 to £19.

Electric Irons

are perhaps the best known domestic appliances, being in use in most households where a supply of current from any source is available. The usual iron is about 6 lb. weight, and loaded to 500 watts. The average user takes current from a lampholder through an adapter, but this is not the best method, as it is desirable that the iron be earthed, and this involves the use of a three pin plug, or alternatively the flex may be permanently attached to a ceiling rose and detached from the iron when the latter is not needed. The circuit should in any case be controlled by a fixed switch on the wall.

Irons cost anything from about 10*s.* 6*d.* up to 18*s.* 6*d.* or more, and have a variable life depending largely on the user. With reasonable care an iron will last many years, and the heating element is easily renewed at a cost of a few shillings.

Experience shows that the best method of wiring for an iron is to wire to a ceiling point, with a wall switch, the cable being 3/·029 or 3/·036, the ceiling point being above the right-hand end of the ironing table and fitted with a three place ceiling rose to receive the flexible cord from the iron. A 5 amp. three-pin switchplug on the wall is an alternative, but the flexible cord trails on the table and is liable to be burnt with the iron in this case.

The end of the flexible cord where it enters the iron, or the connector to the iron, may need occasional attention, as the heat tends to destroy the rubber insulation.

Vacuum Cleaners and Other Domestic Appliances

Next to the electric iron, the vacuum cleaner is the most used domestic appliance. Some vacuum cleaners clean purely by suction, and with these it is difficult to pick up cotton and fluff from carpets, other types incorporate revolving brushes or beaters, or both, and these are more effective in removing the dirt which is deep down in the pile of the carpet and clinging fluff on the surface. It is alleged that the beating and sweeping action damages the carpet, but examination of the contents of the dust bag of cleaners of this type does not prove it. The type of cleaner which is pushed about is more convenient in use than the type with a long hose and separate machine. The current consumption is usually 200 to 250 watts per hour, and no special wiring is needed where plugs are provided for heating or lighting, but, in cases where such provision is not made, it is well to provide plugs for the cleaner. Vacuum cleaners may be supplied from lampholders, but this leads to breakage of lamps and is not practicable on very low voltages. The cost of vacuum cleaners varies from under £6 to over £20, according to type.

Floor Polishing Machines are useful for hardwood floors and linoleum. Some vacuum cleaners of the brush type can be fitted with floor polishing equipment at small cost, or the floor polisher may be a separate machine, costing from about £8 upwards. The current consumption is similar to that of a vacuum cleaner.

Sewing Machines are often fitted with a small motor and a shaded light to facilitate needle threading and the use of the machine generally. The motors take only about 60 watts and may be supplied from a lampholder or any plug point.

Small Portable Motors are available for kitchen use for stirring and beating, and may be fitted with buffs for polishing silver, etc.

Desk and Ceiling Fans are very useful in many cases. Ceiling fans should be permanently wired, but desk fans may be supplied from any lampholder or plug point.

A 12 inch desk fan takes about 50 watts per hour and costs

approximately £4. Smaller fans are available at prices from 25*s.* upwards.

Fans of these types do not ventilate, but they cause air currents which help to carry away the moisture from the body and thereby add to comfort in hot weather.

Health Motors, which give a kind of vibratory action to a waistbelt on which the user leans, and ultra violet light apparatus do not require any special provision other than plug points, and the same may be said of hair dryers and other small appliances.

Radio Sets.—Mains-operated radio sets take very little current, but should be supplied from a three-pin plug, so that they may be earthed. Permanent wiring and plugs may with advantage be put in for supplying loudspeakers in the kitchen and bedrooms.

Small Electric Motors usually take about 1,000 watts per horse power, so that a ¼ h.p. motor may be expected to take about 250/300 watts.

Electric Clocks

The frequency of the " Grid " supply and certain other large generating stations is controlled by master clocks with such accuracy that electric clocks of simple design, driven by small motors running in synchronism with the supply, are now becoming popular. The clocks usually take from ·75 to 2 watts per hour, and are simply plugged in to the supply. In new buildings it is desirable to provide a separate clock circuit, with plugs at each point where a clock is likely to be required. For a house, a pair of 3/·029 cables connected to a separate pair of fuses on the lighting distribution board will be all that is required. Special plugs with ½ ampere fuses are available for clock circuits at a cost of 2*s.* 6*d.* each. The cost of the clocks is from about 30*s.* each. The type of clock described is naturally only suitable for alternating current circuits where the frequency is controlled and the older type of impulse clock controlled by a master clock is still used in other cases.

Electric Bells

Where alternating current is available, it is customary to operate the bell system in a house from the mains, through a small double-wound transformer, so that there is no direct connection with the mains, the transformer being wound for 5 to 8 volts. The no-load loss in the transformer should not exceed 2 watts, and may be less. Every bell transformer should be protected by fuses in both the primary and secondary circuits, and it is an advantage to have a switch in the primary circuit as well, so that the transformer may be switched off when necessary.

Bells for alternating current do not usually have a make and break contact, as the armature and hammer will vibrate in synchronism with the supply without the circuit being interrupted as with battery operated bells.

Indicators may be of the pendulum or mechanical replacement type, the advantage of the former being that they need no attention, and the disadvantage that the pendulum sometimes stops swinging before one has time to see which point the call has come from. Mechanical replacement indicators, in which a disc drops when the bell is rung, are more definite in action, but require resetting each time they are used.

It is important that the resistance of the windings of the bell and indicator be suitably proportioned, or one or the other will not work properly.

It is not generally desirable to use high voltage bells, so where direct current only is available batteries are still necessary for the bells, the cheapest and most reliable form of battery being the ordinary leclanché, or alternatively, dry batteries.

In first class bell installations the wiring is 1/·036 or 1/·044 300 or 600 megohm v.i.r. cable, similar to that used for lighting purposes, drawn into screwed or grip jointed steel conduit, the installation being carried out with the same care that would be taken with a lighting installation. In cheaper work the wires run unprotected under floors and in steel conduit under the plaster on walls. The old type of cotton covered bell wire is not desirable, particularly where the current is obtained from a transformer, as a fault may either burn out the transformer or start a fire.

The best bell pushes are made up of the same type of materials and are interchangeable with ordinary lighting switches, and are fitted with the same type of switch plates. Pushes to outer doors should be so made that water cannot readily enter them. Pressel, or hanging, switches over beds, etc., should be wired with 14/·0076 electric lighting flexible cord, and not with the cheaper bell flexible cord, which soon frays.

THE TESTING OF COMPLETED INSTALLATIONS

I.E.E. Regulation No. 127 deals with the requirements which shall be complied with before an installation is permanently put into service, and it is recommended that systematic inspection and testing of installations should be carried out periodically in order to ensure that they are maintained in sound condition and any undue deterioration promptly detected.

The principal tests called for are two—Insulation Resistance and Continuity of Metallic Sheathing.

The insulation resistance test is carried out with a direct-current pressure of not less than twice the working pressure and not more than 500 volts, and the insulation resistance is measured between earth and the whole system of conductors, or cables, or any section thereof, and the result must not be less than 25 megohms divided by the number of points under test, except that any installation is not required to have an insulation resistance greater than 1 megohm. Lamps and fittings must be in position and switches on when the test is carried out.

The usual method of carrying out this test is to bunch the cables together at the point where they are later to be connected to the meters and connect them to the " Line " terminal of a testing set such as that illustrated in Fig. 29, the "Earth" terminal of the instrument being connected to a cold water main or to the lead sheath of the supply cable. The testing set is usually fitted with a hand-driven dynamo giving 500 volts at 100 r.p.m. of the handle, and a clutch is provided which will slip when 100 r.p.m. is exceeded, thus ensuring a constant testing pressure. The insulation resistance is read directly from the scale of the instrument.

The insulation resistance between the framework and live parts of motors, dynamos, heaters, etc., must not be less than half a megohm.

Although not definitely called for by the Regulations, it is desirable to carry out a further test for insulation resistance between the poles of the installation as represented by the main cables. To carry out this test, all the cables connected to one pole are bunched and connected to the "Line" terminal of the testing set, and all the cables connected to the other pole are likewise connected to the "Earth" terminal of the testing set, and the reading is taken again. If the between poles test is made

with the switches off, it mainly tests the insulation resistance of the switches, and if the switches are on and the lamps and other apparatus disconnected or removed, the test is mainly for the insulation resistance of the lampholders and plugs, etc. Obviously, no reading between poles can be taken with lamps in and switches on, as the poles are short circuited by the lamps.

When the whole system shows low readings, sectional testing should be resorted to until the particular circuit responsible for the low reading has been found, when the cause can be removed. In new buildings dampness is a common cause of low readings, and if the cable ends at switches and ceiling points have been badly stripped so that the braid touches the terminals, the readings may be low. Zero readings usually indicate a definite short circuit which may possibly be caused by a nail having been driven through a conduit or cable or by a mistake having been made by the wireman in connecting the accessories.

The continuity test for conduits or metallic sheathing of the cables should be carried out with a special testing set arranged to measure low resistances. The resistance between a point near the main switch and any other point of the completed installation shall not exceed 2 ohms. The testing set has one terminal connected to the conduit at the main switch, and a flexible lead is taken from the other terminal to the various points from which the resistance is to be measured and contact is made with the conduit or sheathing at these points and readings are obtained.

A rough test to show that the conduit or sheathing is continuous can be carried out with an electric bell and a battery, one pole of the battery being connected to the conduit or sheathing, and the other to both the bus bars of the distribution board or boards. If now the bell is taken to the various switch and ceiling points and one terminal is connected to the conduit or sheathing, and the other to one of the cables, the bell should ring, showing that current is passing through the conduit, and it is therefore continuous. A better test is to pass a current of several amperes through the conduit by means of an accumulator and suitable resistance, readings of the current flowing being taken by an ammeter. To carry out this test, the current should not be fed through the wiring of the installation, but through a flexible lead of constant resistance, so that readings taken from different points may be compared. With this amendment, the test is much the same as the bell and battery test described, but it is better because the heavier current is a more useful test. It must be remembered that if a fault to earth occurs, there is a heavy current flowing through the conduit to earth and really good continuity is important.

Tests for the efficiency of earths are not part of the Regulations at present, but earth testing apparatus is available and the recording instrument is similar in appearance to the testing set for insulation resistance, but the arrangement inside the instrument is different, and it is arranged to read low resistances.

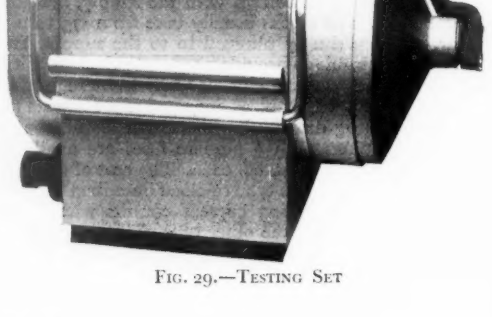

FIG. 29.—TESTING SET

GENERATING PLANT

There are still many buildings beyond the reach of public supplies or situated in areas where the cost of energy is excessive, and in these cases private generating plant is desirable.

For small installations, mainly used for lighting, the prime mover is usually an internal combustion engine using petrol, paraffin, Diesel oil or town's gas as fuel, and directly connected to a dynamo. The selection of the fuel to be used will depend on the size of the plant and the cost of the fuel locally. Small sets up to 1½ kW usually run on petrol, as it is cleaner than paraffin, and sets of 2½ kW and upwards can be run most economically on Diesel oil. With small sets up to 2½ kW, the fuel consumption is about ·75 pint of petrol or paraffin, or ·5 pint of Diesel oil per horse power per hour, and about 2 h.p. hours are required to generate a kWh of electrical energy, or about 2½ to 3 h.p. hours per kWh supplied to the house if the generating set is used to charge a battery and the battery to supply the lighting, etc. These figures apply only to the more economical sets, and some types use a good deal more fuel than that indicated. Diesel oil in England costs about 4½*d.* per gallon in 2 ton lots, and 6*d.* per gallon in 1 ton lots, in barrels, so that the economy of the small Diesel engine over a petrol engine is obvious, but the smallest engine at present made is 5 h.p., and this is too large for the very small house plant, so that petrol engines are largely used. The Diesel engine has no ignition apparatus and the most economical type works on the four stroke cycle, like most motor car engines, but the compression is much greater than in a motor car engine. On the suction stroke air only is drawn into the cylinder, and on the compression stroke is compressed to 400/500 lb. per sq. in., and at the top of the stroke a fine spray or mist of fuel oil is forced into the cylinder head, and is fired by the heat of the compression and the working and exhaust strokes follow.

Very high speeds in generating sets of small size are usually undesirable, and 600 to 1,000 r.p.m. are the most satisfactory speeds. The speed of a direct coupled set of the type described is really a compromise between the most economical speeds of the engine and dynamo, as the engine would preferably be run somewhat slower and the dynamo a good deal faster than the speed of the set, but to slow the set down would increase the first cost considerably.

A 1 kW petrol-driven set is illustrated in Fig. 30, the speed being 1,000 r.p.m., and the radiator for cooling the cylinder and also the switchboard are shown mounted above the dynamo. Fig. 31 shows a 2½ kW Diesel set, the cooling tank or radiator not being shown, and in this case the switchboard would be mounted on the wall.

Accumulators

A set of accumulator cells is desirable in small private installations, as it is uneconomical to run an engine for two or three lights. The battery also ensures continuity of supply in case of slight trouble with the generating set and provides current at all times when the plant is not running. The voltage of a lead-acid cell varies between about 2·08 and 1·85 under normal conditions of discharge, but is fairly constant at about 2 volts for a large part of the discharge period if the rate of discharge is relatively low.

Usually 27 cells are installed for 50 volt lighting, and 60 cells for 110 volt lighting, the extra cells allowing for the fall in voltage towards the end of discharge. Batteries for house lighting are rated on a 10 hour rate of discharge, that is to say, a 100 ampere hour battery will discharge 10 amps. for 10 hours, but it would also discharge 20 amperes if needed, but with a loss of efficiency. Accumulators have a very low internal resistance, and are able to discharge very heavy currents, but the period of heavy discharge should not be prolonged.

Fig. 32 shows an installation of accumulators suitable for a small lighting installation. The accumulators should never be in the same room as the generating plant and switchboard, because, during charging and for some time afterwards, gas is given off from the cells and will attack metals other than lead.

The switchgear usually provides for switching in the end cells as the voltage falls on discharge, but this is not done with fully automatic sets, as the number of cells in this case is less.

Switchgear.—The switchgear provided with small sets provides for controlling both the dynamo and the outgoing supply, and an automatic switch is included to switch in the dynamo when its voltage is above that of the battery, and cut it out again if the voltage falls to a point where the battery would be driving the dynamo as a motor, as in a case of engine stoppage. Most sets have provision for starting from the battery by motoring the dynamo, so that no hand starting is necessary. Some sets are completely automatically controlled, so that the first few lights or other small load put on does not start the set, the current being supplied from the battery, but when the load reaches a pre-determined amount, the set is started and continues to run until the load has fallen below the figure at which it started, when it is automatically stopped. Provision is also made for starting the set if the battery is run down through supplying small amounts of current for a long period. There are many variations of the methods of controlling and running automatic plants. Where the set is automatically controlled, the number of accumulator cells is less than in battery charging installations, 52 cells being correct for 110 volt lighting. This, of course, means that when the plant is not running, and there is no load to supply except one or two lights, the voltage will be about 104 to 108, and when the set is started the voltage will rise to perhaps 115, at which figure the battery will be partly charged at the same time as the lights are in use. The variation in voltage does not show so much as might be expected. With automatic working the battery will need occasional special charges to keep it in condition, as it cannot be fully charged when the lights are on, otherwise the voltage would rise to nearly 140 and burn out the lamps. The makers' instructions should be followed in this matter or the battery will have a short life.

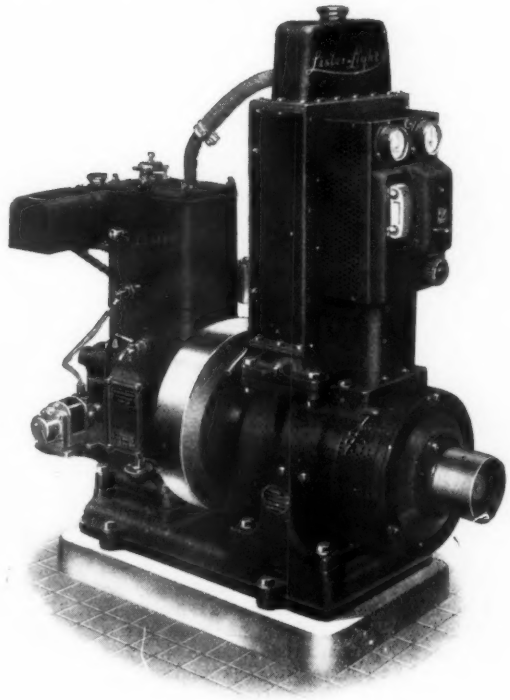

Fig. 30.—Generating Set

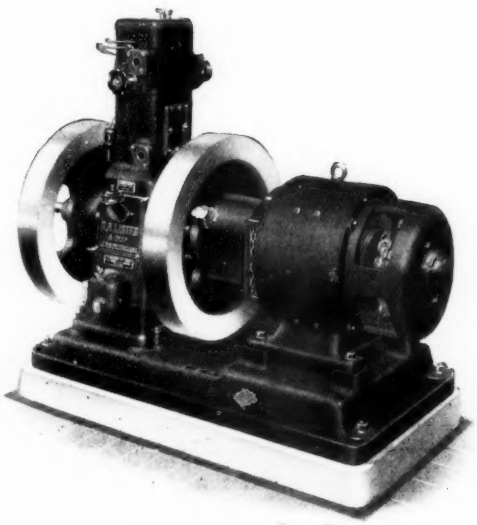

Fig. 31.—Generating Set

Selection of Voltage for Private Plants

The question may arise as to the most suitable voltage for a private plant, and this is a question of size of plant, use to be made of it, and also cost. The usual voltages are :

25 and 32 for small plants up to 1·5 kW, supplying lighting only, and where the plant is very near the house, so that there are no long runs of cable.

50 for plants up to 2 kW, used for lighting only, with perhaps a vacuum cleaner or other small domestic appliance occasionally.

110 for all plants from 1 kW upwards for lighting and small power work. 100 volts is also a common pressure in England.

230 for plants of 2 kW and upwards where the supply may later be taken from a supply undertaking, but this pressure would need too many accumulator cells for a battery-charging plant and would only be adopted where the set was to run direct on to the lights.

The reason for the use of pressures below 110 volts is that it is cheaper to provide a few large accumulator cells than a larger number of smaller cells of the same collective capacity. For example: a 110 volt battery of 60 cells would cost about 25 per cent. more than the equivalent 27 cells for 50 volts. The drawback of low pressures is that the amperage to be carried is proportionately heavier, and as the fall in voltage due to resistance in cables is proportional to the amperage, the voltage drop becomes a serious matter. Each 1 per cent. variation in voltage produces about 3 per cent. variation in the light from incandescent lamps of the vacuum or gasfilled types, so that the voltage drop in wiring installations is limited by I.E.E. Regulation No. 74 to 1 volt plus 3 per cent. of the pressure of the supply, and this means that the sectional area of low voltage cables has to be increased disproportionately to the current they carry. Sometimes 25 or 32 volt installations are wired with cables of the same sizes that would be used for 200/250 volts, and the voltage drop is very obvious in the reduced light, and there may be risk in the overloading of the cables.

Probably 110 volts is the most suitable voltage for private installations of 1 kW and over, as standard types of lamps and domestic appliances are available for this pressure without being specially ordered. Low voltage lamps are more expensive in most makes than the standard types for 100/250 volts, the difference in cost being as much as 1*s.* 1*d.* to 1*s.* 7*d.* for the popular sizes of 25 and 60 watts.

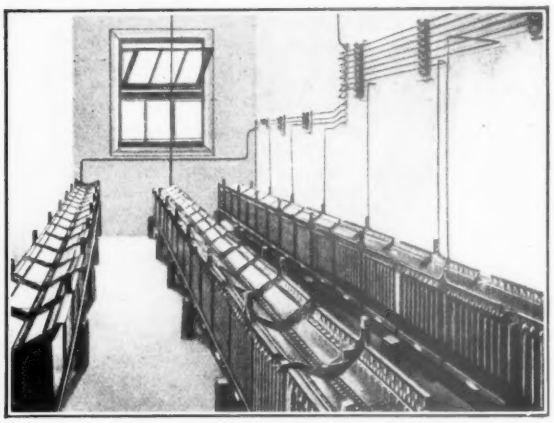

Fig. 32.—Accumulator Set

Selection of Plant

The type of plant most suitable for a particular installation must be determined by the conditions under which it is to operate, the following being the principal types:

(A) *Direct Lighting* in which the engine and dynamo run at all times when light is required, the engine being closely governed and fitted with a heavy flywheel to ensure steady running and the dynamo being compound wound to give a practically constant voltage under all load conditions. If it is likely that a battery will be installed at a later date, the engine should be fitted with a magnetic governor, and the dynamo should be shunt wound, as a compound wound dynamo is unsuitable for battery charging.

Some direct lighting plants are fitted with a motor car starter motor and 6 or 12 volt battery, and are either started and stopped by push button control from the house or may be started and stopped by the action of switching the lights on or off, the set being controlled by relays on the switchboard.

Direct lighting sets usually generate direct current at 110 or 220 volts, but where change over to mains supply is probable at a later date, the voltage should be the same as the mains, and any small motors purchased should be of the "universal" type, which will run on either direct or alternating current circuits. It is possible to generate alternating current, but a small alternator is much more expensive than a dynamo.

Direct lighting is not recommended for houses in regular occupation, but is suitable for week-end houses and places where the light is required at fixed times, and no current is needed in the intervals.

The capacity of the plant must be sufficient to supply the maximum number of lights ever in use at one time, and this is either the total number installed or less, according to the conditions of use.

The drawbacks of direct lighting are the absence of stand-by in case of slight troubles necessitating the stopping of the plant and the relatively heavy fuel consumption at light loads.

The approximate costs of small direct lighting sets, without automatic or push button control, 110 volts direct current and compound wound dynamos, are as follows:

1 kW Petrol set,	1,000	r.p.m.	with	switchboard	complete	£65
1·5 kW	do.	do.	700	do.	do.	do.	£90
2·5 kW Diesel	do.	600	do.	do.	do.	£155
4·5 kW	do.	do.	1,000	do.	do.	do.	£225

(B) *Battery-Charging Plants*, in which the main function of the generating set is to charge a battery during the day, the battery supplying the current at night, except at times of specially heavy load, when the set may run to relieve the battery of some or all of the load. This type of plant offers the maximum of reliability as the battery is available for lighting, etc., at all times, and can provide current for a time if the generating set is under overhaul or repair. Although only about 75 per cent. of the energy put into a battery can be taken out of it, the fuel costs of this type of plant are usually less than those for direct running plants under the normal conditions of house lighting.

The size of plant is usually determined by taking the average wattage of lamps in use and allowing a battery of sufficient capacity to supply them for 15 hours on one charge, the generating set being large enough to charge the battery in about 7 hours.

Example: If the average number of lamps in use is, say, 12, with a total wattage of 300 and the voltage is 50, the amperes are therefore 6, and 6×15 hours $= 90$ ampere hours. The nearest standard set in a maker's list is 1 kW 50/73 volts, with a 27 cell battery of 100 ampere hours. This set would require to be run for charging for about 6 hours every two days in winter and about once a week in summer in England, and would consume about 9 pints of petrol in 6 hours.

The approximate costs of battery-charging plants complete are as follows :—

·5kW Petrol set,	750 r.p.m.	32 v.,	16 cells,	100 amp. hrs.	£85
1·0kW do.	1,000	do.	50 v.,	27	do.	100	do.	£130
1·5kW do.	700	do.	110 v.,	60	do.	75	do.	£208
2·5kW Diesel	600	do.	110 v.,	60	do.	125	do.	£330
4·5kW do.	1,000	do.	110 v.,	60	do.	200	do.	£468

The costs may be reduced by fitting batteries of less capacity, but this is not generally advisable as they need more frequent charging and the wear and tear on the generating set is increased thereby.

The life of the battery in sets of the above type should be 12 to 15 years if it is properly used, and at the end of this time new positive plates will be required, the negatives usually lasting the life of two sets of positives.

(C) *Fully Automatic Plants* are of several types :

1. Direct running plants already described.

2. Battery charging plants, but with the addition of automatic features so that the battery is automatically recharged when run down, and the set is automatically started at times of heavy load to relieve the battery, and

3. Sets with a relatively small battery which supplies a few lights, the set starting up when the load increases to a pre-determined limit and stopping when the load falls a little below that limit.

The first type are expensive in fuel consumption, and involve fairly heavy depreciation as they have to run about 2,000 hours per annum in most cases.

The second type are expensive in first cost owing to the automatic switchgear required, but are economical in fuel consumption. They need to be kept in first-class condition if the automatic features are to work unfailingly.

The third type are cheaper to install than the second as they have small batteries and less expensive switchgear, but the fuel consumption and wear and tear are somewhat greater. This type of plant shows to the best advantage where there is a regular and proportionately heavy load for several hours per day and where at other times only an occasional light or two have to be supplied. Some plants are fitted with very small batteries, and the 1 kW sets start when the load reaches 120 watts and stop when it has fallen to about 50 watts, being therefore comparable with direct running sets, as they run most of the time that light is being used and therefore in the case of most houses run at 15 to 25 per cent. of full load most of the time and take probably half the full load fuel consumption.

Other makers compromise and recommend larger batteries which supply the lighting at times of light load, and thereby reduce the running time and fuel, as the battery is being charged to some extent, whilst the dynamo is supplying the heavier loads. Notes on the variation in voltage with plants of this type are included in the paragraph dealing with switchgear and the prices of them are given below, the voltage in each case being 110 and the number of cells in the battery 52.

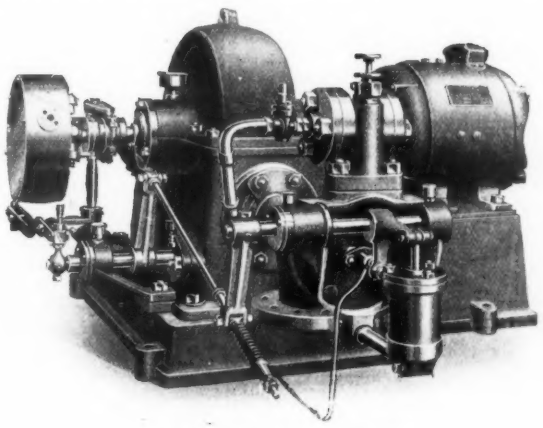

FIG. 33.—WATER POWER SET

1 kW Petrol set with	50 ampere hour battery	..	£135
1·5 kW do.	do.	50	do.	..	£196
2·5 kW Diesel	do.	75	do.	..	£307
4·5 kW do.	do.	150	do.	..	£445

Fig. 30 shows a 1 kW petrol set and Fig. 31 a 2½ kW Diesel set, both of which can be arranged to operate in any of the ways described.

For most small houses the battery-charging set is likely to prove the most satisfactory type provided some attention can be given to the charging of the battery.

WATER POWER PLANT

The possibilities of utilising water power are always worth exploring where the supply of water is fairly constant and sufficient to develop 1 b.h.p. or more.

Water power can be used with any fall from 2 feet upwards, the amount of water required being about 730 cubic feet per horse power per minute per foot of fall, or, of course, 73 cubic feet per h.p. per minute with a 10 feet fall. Low falls are relatively expensive to utilise as the turbine is comparatively large, and the governing of the speed sufficiently closely to enable the dynamo to supply the lights direct is a rather expensive matter. With very small falls, the generating set may be arranged to charge a battery, the governor being dispensed with, if the size of plant is only, say, 1 to 2 kW.

Where falls of 70 feet or upwards are available, and the supply of water is constant, or in excess of the requirements of the plant at most times, small generating sets may be installed to run direct on to the lights, the speed being very closely controlled by a governor on the turbine shaft, which deflects the jet of water when the speed tends to increase above the limit set. These sets take the full amount of water, irrespective of the load, and where water is drawn from a dam and the supply is not always equal to the full output of the plant, an economiser is interconnected with the governor, so that the amount of water used is proportionate to the load. Fig. 33 shows a set of the latter type complete with economiser.

A small set of this type, capable of developing from 1 kW to 4 kW, according to the size of the turbine wheel, or runner, and the fall and water available, forms an ideal house lighting set, as there are no fuel costs, and the set can be used for water heating or building heating when not required for lighting.

The costs of the plant complete with dynamo and switchboard are as follows : The prices do not include economisers.

1 kW.	300/160 feet fall or head of water	..	£116
1 kW	160/120	do. ..	£137
1 kW	120/70	do. ..	£142
2 kW	160/100	do. ..	£156
4 kW	240/155	do. ..	£173

These prices are typical, of course, and do not represent the whole range available. Taking the smallest set for a 70 feet fall, the cost of installation, including say, 140 yards of 5 inch pipe line, forming intake, with sluice, tailrace and valves, and building small power house, would probably amount to about £170. The amount of water required would be 22 cubic feet per minute and the output 1 kW. The total cost of plant and installation, £312 or thereabouts, is, of course, much more than the cost of a petrol driven battery charging set, but there is no fuel cost, and this small set is quite capable of providing all the hot water required by four or five people, in addition to lighting.

Where water conditions are suitable, a set of the type illustrated will usually run continuously night and day with very slight daily attention, and therefore full use can be made of the output without increasing the cost of running.

Tariff Systems

Most supply undertakings offer current at from 3*d*. to 9*d*. per unit for lighting, and ¾*d*. to 4*d*. per unit for heating and cooking, etc., on a flat rate, according to the units consumed, but these rates, except perhaps the ¾d. rate suggested, are not low enough to permit people of moderate means to use electricity freely.

Alternative tariffs on a two-part basis are common, the fixed part being based either on rateable value, floor area, number of rooms, or maximum demand at any one time, and the other part being usually ½*d*. to 1*d*. per unit for energy supplied for all purposes.

Where it is intended to make generous use of electricity, the two-part tariff is usually the most economical to adopt, but it may not be so where the house is large and the family small, and where comparatively little current is likely to be used. Each case must be worked out on its merits, no general rule can be laid down.

It is often asked why current from the same mains should be charged at, say, 4*d*. for lighting and 1*d*. for heating, and why lighting and heating on the two-part tariff should be charged at the same rate. One reason is that lighting is required for an average of 4½ hours per day, and during the rest of the day the power station plant might be standing and doing nothing so far as the lighting consumer is concerned, with resultant increased overhead costs, which the higher lighting rate is designed to cover. With cheap current the hollows in the power station's load curve are at least partly filled up by the domestic consumer, and the proportion of overhead charges is reduced.

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The Proposed Building Industries National Council

AN HISTORICAL SURVEY

AFTER years of more or less continuous effort, and to some extent by the age-old process of trial and error, there is at last some reason to believe that the dream of a comprehensive central council for the Building Industry and its allied industries is about to be realised.

It is some fourteen years since what was then termed the "Building Industry Parliament" was brought into being as a result of the feeling that prevailed during the latter years of the war and immediately after, that some form of central organisation was necessary to meet the demand for national reconstruction.

Conditions changed, however, and the time came when it was felt that the "Parliament" had served its immediate purpose. Whatever this short-lived "Parliament" did do, it certainly did sow seeds of organised unity in the industry, and indicated lines of unified development which the industry might well follow.

The few, but very valuable, records that remain of this old "Parliament" are still in the possession of the writer. They will be of inestimable value to the future historian who may be called upon to write the industrial history of the twentieth century. The men, many of them happily still living, who played a part in this early, and withal somewhat daring, experiment, will almost certainly find some little acknowledgment in the history of the industrial edifice of their time.

Partly as an offshoot of this old "Parliament," there arose, perhaps somewhat obliquely, but with the same underlying sense of the need of organised unity in industrial relations, the National Joint Council for the Building Industry. This Council, for the first time in the industrial history of the country, put the administration of the industrial side of the largest industry in the country upon a national and constitutional basis, which in its present form represents the greatest measure of progress in industrial relations agreements yet developed by any industry. The pioneers of this great sectional effort for constitutional relations are now reaping the fruit of their labours in the manner in which the Building Industry is withstanding the greatest strain in its history—the present stress of unemployment. While the agreement under which this Council functions is bearing this enormous strain it is, at the same time, preserving the grounds of industrial relationship which will enable the industry to meet, with ease, the widespread reaction which must almost inevitably follow the present period of depression.

After a further period of a few years and still as a result of what was felt to be the need of full professional and industrial consultation, the Building Industry Council of Review came into being. This Council, which in its composition was a small, but none the less earnest, replica of the older "Building Parliament," issued in 1930 what has come to be regarded in some quarters as one of the most comprehensive reports ever produced by the industry.

Following its recommendations arose a number of efforts for action upon national lines, one of which was the formation of the Building Divisional Council of the British Standards Institution.

At the same time was also formed the Advisory Council of the Building Industry. These three bodies are now functioning freely and effectively, but without that degree of co-ordination which is recognised to be so necessary if the best is to be obtained in national effectiveness.

Because of this and in recognition of the tremendous keenness shown by the Industry in general in the work of the two definitely Building Industry Councils, namely, the Building Industry Council of Review and the Advisory Council of the Building Industry, it was thought to be both wise and opportunely constructive to combine these two efforts under one all-embracing and more comprehensive central council.

The Draft Constitution for this Council is now receiving consideration by the bodies represented at the Conferences convened at the R.I.B.A. for the purpose of bringing the Council into being. It has been drawn up with the object of constituting a Council fully representative of the professional, technical and industrial sides of the industry.

While, however, the constitution, under these heads, is all-embracing on matters of common interest to the industry, it preserves clearly, definitely, and wholly the complete autonomy of the bodies represented upon the Council in matters which are, and must of necessity remain, their own domestic concern.

The ambit of the proposed National Council will be such that the professional bodies, technical institutions, trades and the industrial associations of the industry can put the weight of their experience and efforts at the disposal of the industry for its general well-being.

It is significant that the Building Industry has during the last thirty years so grown, almost imperceptibly, to be the largest directly employing registered industry in the country. It has become the industry upon which almost every other form of industry depends for, in some part, the investment of its capital, and in some instances the greater portion of its capital. In the creation and stabilisation of national wealth it is pre-eminently the most fundamental industry of the country.

This position has been attained in spite of a process of continual changes in building technique, practice and

design, involving many new processes and conceptions of craft, trade and professional interests. During the more recent years changes in technique and practice, and in types of material, have become more and more drastic; but the changes have served to emphasize the need for some measures of national representation which will enable the industry to obtain, on the one hand, concerted action along any line that has in it the seed of constructive development, and, on the other hand, to enable it to speak with one national voice when such is felt to be necessary.

The Industry has gathered, in the course of centuries, habits and technical practices which from time to time call for at least some element guiding examination. It has developed round itself a mass of written and unwritten legal enactments which unquestionably prevent its free and full functioning and increase costs unduly.

It is a further fact that as the present phase of industrial policy in this country develops, greater demands than ever before will be made upon the Building Industry as an essential part in industrial and social progress, and it is vitally important that this great potential activity shall not be frittered away in sporadic effort for lack of rational guidance.

At the present time it is impossible to foresee anything approaching such a great industrial revival in this country during the next fifty years as was experienced in the first half of the last century; yet with the development of the social and industrial sense of the country there is an equal, if not a larger, task before the country of industrial and social reconstruction.

No one can safely assume that the present structural, industrial or social standards of our great industrial towns will be allowed to remain on the present level any more than it can be assumed that under the working conditions prevailing in many of our factories, which were sporadically built about the period of 1850, it is possible to withstand the competition in output from factories of modern construction.

There is every sign of potential activity for the Building Industry, if it can only be organised on planned lines. It is of such a nature, however, that some degree of national planning and guidance is essential if the costly breakdowns in previous national efforts of this nature are to be avoided.

It is with these great possibilities in view that it is felt by the Conference founding the Building Industries National Council that so much constructive work can be done, in seeing, not only that the future efforts of the Industry are executed in as truly a productive and economic manner as possible, but that, above all, the Industry does not, as it has so often experienced in the past, become the mere plaything of varying industrial or social policies, the effect of which has had such disastrous effects upon those dependent upon the industry.

The new Council will, no doubt, realise that it accepts a heritage of care, thought and regard for the Industry. It must also see that that heritage is not dissipated in mere sporadic and disjointed effort.

There are few matters in the Building Industry which, while being of individual concern, are not in fact, from some aspect, the direct concern of the whole. The spirit of national unity of action and effort, which is one of the signs of the times in other industries, must be engendered to the fullest extent in our own. If the Building Industries National Council does nothing more than constitute for the Industry a national outlook, it will more than justify itself.

Finally, it cannot be too clearly understood that the proposed National Council is representative of the livelihood of something in excess of two millions of workers, and probably 150,000 professional, trade, and clerical employers and employees, a great body that has never before had a representative voice to speak for its common interests. These common interests are many, widespread and perhaps somewhat involved. The responsibility, therefore, of those forming the new Building Industries National Council is no light one. It requires the earnest thought and practical help, support and effort of all those in the Industry whose sense of well-being enables them to appreciate the need there is, under modern conditions, of a form of national representation for such a great industry, and how effective for the good of all their united efforts may well be.

The Wren Tercentenary Exhibition

THE TROPHY ROOM, ST. PAUL'S CATHEDRAL

THERE is an appropriateness in the setting of the Wren Tercentenary exhibition that must enhance its value a hundredfold; for to reach the Trophy room in St. Paul's Cathedral we must force our passage through the tortuous disorganisation of the city streets, preparing ourselves by our sufferings to appreciate Wren's vision of the replanned city, then with our eyes on the city churches and St. Paul's dome we come to the most glorious vestibule that any exhibition can ever have had, the aloof vast spaces of the cathedral itself through which we must pass and up the broad winding stair, as an insight to the anatomy of the building, to the Trophy room itself, which, as one of the vergers said, now really *is* a trophy room. And all this while unless we are of that harsh disposition that disdains the softening influence of sentiment will be the thought that beneath this great monument lies Wren himself under his simple slab. And so to the exhibition. It is difficult in this limited space to do justice to so rich a display, in which everyone will find things to instruct and delight; its interest is largely in that it is broadly illustrative of every age of Wren's life and every sphere of his work. The accurate study of documents cannot obviously be made across the necessary barrier of frames and glazing, nor can any collection pretend to be as complete or as fully instructive as the records of Wren that have now been published by the Wren Society. With this limitation in view the organisers have wisely chosen to concentrate on the personal side and relics of Wren's life and time rather than to make the exhibition predominately technical and architectural. It is, however, a pity that more actual examples of Wren's draughtmanship could not have been shown, especially as the cathedral itself possesses the two large volumes of drawings which better than anything else show the care with which he considered and reconsidered every element in his designs. The few architectural drawings in the exhibition are not of the greatest importance. The visitor to the exhibition has his attention taken on entering by the great model which fills the centre of the room and rather dwarfs the other exhibits. This model of Wren's favourite design was made in 1673 by the foreman joiner William Clare, under Wren's supervision. Even among the perfections of the present cathedral we can mourn the sad fact that Wren was unable to have his way and follow this design, a design which, to quote Sir Mervyn Macartney, "would have been one of the most perfect and rhythmical buildings ever created." Beside it is a beautiful water-colour which has just been completed by Mr. Walcot to show this "favourite" design set among the colour and activity of modern traffic and near by on the walls are two large drawings, from the R.I.B.A., by J. E. Goodchild showing the interior.

For most people the chief interest will be in the portraits. The collection is as complete a one as is ever likely to be made, and if for nothing else the exhibition should be visited for the opportunity it gives of seeing side by side the Welbeck Portrait, the Royal Society Portrait and the Deanery Portrait, the last being a variant of the famous portrait at the National Portrait Gallery. There is the R.I.B.A. cast of the Ashmolean bust by Edward Pierce, the beautiful posthumous Rysbrach bust, and, perhaps most precious of all, the death mask from All Souls. There are in addition a number of portraits of other members of Wren's family, including his son and daughter, Christopher and Jane, and an extremely interesting portrait, lent by Miss R. M. Davenport, of Edward Strong, Sir Christopher's faithful master-mason.

The documents are so many and so varied in their appeal that we cannot hope to refer to more than a few. The R.I.B.A. has lent the holograph letter from Wren to Mr. William Vanbruck, secretary to the Greenwich Commissioners, in which he apologises for his enforced absence from a meeting at Greenwich as he has to attend at St. Paul's, and the interleaved Parentalia which is full of Wren manuscripts of inestimable value. There are the subscription list volumes for the building with the signed offers from Charles II and James, which can be contrasted with the sumptuous volume of the subscriptions to the recent restoration. From Salisbury Cathedral have come the reports by Wren on the stability of the tower and the Dean and Chapter of Christ Church have lent seven letters written during the building of Tom tower.

More personal relics are various articles of clothing worn by Wren, the record of his birth in the registers of East Knoyle Church and of his first marriage from the Temple Church, his compasses, a sugar castor designed by him, and many other delightful trifles.

The organising committee, of which Mr. Gerald Henderson, the sub-librarian, is secretary, deserve our thanks and congratulations on having provided an exhibition of much of value and interest. We hope that it will lead many people to St. Paul's, and that many among the visitors wise enough to cap the delights of the exhibition by continuing the ascent to the Stone Gallery, one third completed by the journey to the trophy room, so that before leaving the Cathedral they may look out over the city and over the many white spires of Wren's city churches.

Reviews

BUILDING RESEARCH*

A REVIEW BY LT.-COL. P. A. HOPKINS, O.B.E., F.R.I.B.A.

In this, the sixth report issued by the Building Research Station since its formation in 1920, Dr. R. E. Stradling reminds us of the great progress that has been made in the development of a science of building. We no longer need depend on rough methods of testing by trial and error, but can obtain with the station's assistance exact information on all the many materials in use. For this advance we have to thank Dr. Stradling himself, who has continuously waged a crusade to establish a Science of Building and to get members of the architectural profession and the building trades to take full advantage of the facilities offered by the Research Station.

It is not possible to give details of the work of the B.R.S. in a short review such as this, but broadly: the Report states that the Science of Building has been studied under four headings—Weathering, Materials, Structures and Efficiency. The information given includes the exact chemical structure of building materials, "Ancient and Modern," their good and bad qualities, and advice as to their use—there is also much up-to-date and hitherto unpublished information on the problems of heating, ventilation, acoustics and sunlight.

A perusal of the Report indicates that the scientific use of building materials will materially increase the stability of our buildings and at the same time eliminate the superabundant strength which is always to be found in some part of a structure erected by the traditional method, thereby saving space, superfluous weight and its support—excess expenditure on labour and material, etc. There can be few specifications which cannot be improved, both from the efficiency and finance points of view, as a result of a careful study of the Report, and the other publications issued by the B.R.S.

It is said that there is no waste in nature . . . this is within measurable distance of being true also with respect to the productions of man, thanks to the discoveries of our scientists—those great mountains of waste which disfigure the landscape in our mining areas will shortly become the raw material of modern construction, this is no idle statement, ample proof is already demonstrable at Watford as far as at least one type of waste which has been accumulating for generations.

Dr. Stradling and his staff are to be congratulated upon this very valuable and interesting report, and also on the ingenuity displayed in the production of much novel apparatus for the furtherance of their investigations; two of these recent inventions will be of great use to the architect, the new application of the principle of the pin-hole camera and the Heliodon, both of which were fully described in the recent report of the committee on the Orientation of Buildings published in the last number of this JOURNAL. Though the report is only able, in its 150 pages, to summarise the results of the work completed and in progress, it is so full of important information that it is an essential part of the equipment of every architect's office. Half of the difficulties met with in practice could be solved by an enquiry at the station or by reference to its many publications, and this brief review will have served its purpose if it persuades a few more members of the R.I.B.A. to accept its help.

THE ARCHITECTURE OF THE PILGRIM FATHERS†

A REVIEW BY EDWIN GUNN, A.R.I.B.A.

Though a work written by an architect, and in a manner which may be read by architects with pleasure and profit, the main appeal of this book is obviously to that section of the American public which is proud of its roots. Its object is to establish a link between the earliest buildings of the New England colony and contemporary buildings in East Englia, and that such a link exists may be taken as demonstrated, though most readers may perhaps believe that Mr. Briggs is apt to exaggerate the affinities a little, and to introduce as evidence examples which are hardly in the chain.

We may all be grateful to him, however, for his devotion to the weather-boarded house and mill, which has led him to pursue and record with many charming sketches and photographs a wide selection of these disregarded and despised but friendly and charming buildings in South-east England. It matters little to the argument that few of the examples included would be found on close scrutiny to have started their life under timber cladding. Weatherboarded houses, in most cases prior to the early eighteenth century, prove to be oak frame houses whose wattle and daub or brick infilling has needed an overcoat: which in Suffolk was usually plaster, and in Kent, Surrey or Sussex tile hanging, but in Essex generally, and sea coast towns sporadically, lapped boarding. Mills and farm buildings in many counties (not excluding some where stone, brick, or cob was the common resource) would often be timber and boarding, this being less peculiar to the Eastern Counties than for the author's purpose it is claimed.

As soon as Baltic softwoods became established as an everyday commodity the frame house built to be boarded externally from the start became more usual, and many charming Geor-

* *Department of Scientific and Industrial Research.* Report of the Building Research Board for the year 1931. London: H.M. Stationery Office, 1932. 3s.

† *The Homes of the Pilgrim Fathers in England and America (1620-1685).* By Martin S. Briggs. London and New York: Oxford University Press. 18s.

gian examples remain, while more have lately perished—but these are after the last date covered, and may conceivably even have been influenced by Colonial practice, though there is no need to press that point as a vital factor to induce what was so demonstrably an obvious and sensible manner of building; the invention of oil paint is more likely to have helped. The important fact for Mr. Briggs's argument is that in most of the East Anglian villages whose names were given by the pilgrims to their new settlements, timber houses with overhung storeys weatherboarded externally existed in large numbers. What more natural, then, that the colonists, faced with the need for shelter and confronted with a shortage of lime and abundance of usable timber, should evolve a manner of building bearing a colourable resemblance to the work with which they had been familiar.' This appears to be exactly what happened, and the examples of early American houses which are illustrated suggest the efforts of amateurs and workmen striving to reproduce, from recollection only, buildings on the lines with which they had been once familiar. There are a few obvious points of difference, as in the narrower and more numerous lines of boarding with which the houses are clad, the curious survival of the drop finial, and the distinctively individual form named "hewn overhang" which more than any other suggests an amateur's effort to secure a projecting upper storey without realisation of how it is done. The plans reproduced from J. F. Kelly's *Early Domestic Architecture of Connecticut* might be duplicated in contemporary and earlier buildings in almost any English village—they are of the well-known types with one (or two) rooms below and a similar arrangement above, having a ridge chimney stack of massive dimensions allowing breadth for an entrance porch and stair within the limits of its bulk, without encroaching on the rectangularity of the rooms.

Mr. Briggs owns indebtedness to many American authors in his descriptions of the pilgrims' New England buildings, about which a considerable mass of historical writing has collected; and the second part of his work (Chapters VI and VII) which is devoted to this side of the matter, will have for English readers perhaps the greatest interest, from its slight strangeness—a sort of familiarity, with a sea-change. A good many of the examples illustrated have undergone extensive restoration, or even complete reconstruction, and perhaps in consequence of that some of the details have a harsh appearance not strikingly resembling authentic work on this side—windows in particular seem apt to resemble the types which more often grace "ye olde" tea shop. But the pride and care with which these houses are cherished should be a lesson to us who permit hundreds of finer examples annually to be defaced or destroyed, and if Mr. Briggs' book brings that fact home to us it will have served a purpose here besides its main aim in America. EDWIN GUNN.

ENGINEERING EQUIPMENT

THE ENGINEERING EQUIPMENT OF BUILDINGS. *By A. C. Pallot, B.Sc. Lond. : Pitman & Sons*, 1932. 15s. *net.*

Reviewed by ALAN MUNBY [*F.*].

That modern buildings demand an ever increasing call upon the engineer in the matter of equipment will be readily conceded. Whereas half a century ago requirements beyond heating, lighting and water supply were few, to-day the architect is faced with the provision of lifts, ventilating and refrigerating plant and other services largely dependent on the great developments of electricity and in special cases, as in laboratories, with vacuum and compression plants, to name only a few.

The importance of fully visualising these services and making provision for them before working drawings are prepared so that construction shall conform to their requirements, though it should be evident, still appears to need stressing, for instances of alterations in new buildings required by such services, which could have been avoided, are common.

The architect cannot be expected to be an engineer, but he should possess sufficient knowledge of engineering problems to enable him to provide for them in his buildings and to control and co-ordinate this engineering work. Hence Mr. Pallot's book is to be welcomed, and the more as it deals with the subject in a manner which the architect will appreciate. While the author does not claim that his work is more than a survey, its 334 pages will be found full of detailed information and illustrations of the greatest interest and value.

After a short preliminary chapter on the general arrangement of buildings and steelwork relative to the location of engineering plant, nearly a third of the book is devoted to four chapters on electrical work, an allocation which the rapid advances of this science quite justify. The conditions of electric supply and transformation from alternating to direct current are fully explained and information is given on such modern rectifiers as mercury transformers and trickle chargers. Wiring systems are compared and under "Lighting" the author discusses the merits and efficiency of various forms of illumination. Under "Electric Power" various forms of motors and their windings for different purposes, the use of rheostats and like problems are explained with the aid of many illustrations. Next follow two chapters on water supply and pumps which include accounts of well sinking, storage water, impurities and pumps of different types. Nearly 100 pages are devoted to heating problems, boilers, fuel and chimneys, heating systems and hot-water service being described with much useful statistical data. A chapter on ventilation and air conditioning follows, and then 25 pages on lifts. Among such a wealth of information it seems churlish to ask for more, but one could have wished for a dissertation on the trying habits of A.C. lifts and advice on conversion to the smooth waters of D.C. Short chapters on fire protection, dust extraction, refrigeration and kitchen equipment, lightning conductors and bells conclude a most interesting volume. The reviewer's difficulty has indeed been to treat the book as for review and not to peruse every page as a student absorbing information, and he feels sure that any architect who will read the book must close it with a sense not only of added respect for the engineer but with a feeling that where his services are necessary contact should be established at the birth of his design. Only in this manner will troubles, alterations and expense be eliminated at the later stages of the work. Mr. Pallot has collected between the covers of his book an immense amount of diverse information necessary for the equipment of the modern building which should do much to bring the architect and engineer into closer contact.

THE ITALIAN RENAISSANCE

THE QUATTRO CENTO. *A different conception of the Italian Renaissance. Part One: Florence and Verona. An essay in Italian fifteenth-century architecture and sculpture. By Adrian Stokes. London: Faber and Faber, 1932. £1 5s.*

Reviewed by THEODORE FYFE [*F.*]

At the present time there is a pronounced tendency to study afresh the great formative periods of art rather than its by-ways and to discover special meanings in them. Art criticism, in one of its aspects, has become intensely, personally interpretative, a discoverer of rare essences, of various flowerings and fruitions that have so far been overlooked. The work now under review falls into this category. A sub-title defines it as "a different

conception of the Italian Renaissance." In point of fact, as the title page also discloses, it is an essay in Italian fifteenth-century architecture and sculpture. We are given to understand that two more parts (or volumes) will follow, and that one of these will deal with Venice and Dalmatia.

To do Mr. Adrian Stokes full justice, his research is extensive to a very high degree, just as his method of interpretation is intensive to an equally high degree. There is an inevitableness and directness in the formulation of opinion that is a strong reminder of Ruskin: but a besetting lack of clarity in expression and a tendency to become heavily involved in argument are far away from Ruskin. One instance, from p. 37, shows a typical failing—"Rustication is absolutely meaningless in London streets, *but* screening a steel frame from the weather." (The italics are mine.) Now it is clear that Mr. Stokes can only mean "where it is screening a steel frame from the weather"; and it would be both more correct and more intelligible if he would say so.

The author explains near the beginning of the book (see pp. 7 and 15) that he has a limited meaning for the real "Quattro-Cento." It is, in sculpture, something that "made stone to bloom." This we could understand, but when the opposing Plate II, which illustrates a very lovely window, is lettered "stone blossom 'immediate, without rhythm, like the open face of the rose,'" we are all abroad; nor are matters really made clearer in the sculptural definition on p. 15, where again the highest type of "Quattro-Cento" architecture is defined as "a mass-effect in which every temporal or flux element was transformed into a spatial steadiness." It may seem rather unfair to select snippets like these from a long and serious essay, but the uncomfortable fact remains that they illustrate quite typically the method of the whole.

The book is strongly provocative, as might be expected. Most of the great names are handled severely. Brunelleschi, Ghiberti, Luca della Robbia and Verrochio (with the exception of one work of each), Mino da Fiesole, Benedetto da Majano, Pollaiuolo, and (especially) Donatello, are exposed as purveyors of a cold classicism, a brutal dynamic force, or some other quality which is not the "Quattro-Cento" undefiled. Michelozzo and Desederio da Settignano come off rather better, but escape so as "by fire." A lot of this criticism may be very sound: it is impossible to say without much more profound knowledge than the present reviewer possesses. It is enough to indicate that many established reputations are subjected to a very white light by Mr. Stokes, though he is fully capable of appreciating the great qualities of which their possessors were capable, in certain directions.

The heroes of the book (with Piero della Francesca in the background) are Francesco di Giorgio and Luciano Laurana, as architects, and principally in connection with the ducal palace at Urbino; Francesco Laurana, the sculptor brother of the same palace; and Matteo de' Pasti and Agostino di Duccio, the architect and sculptor respectively of the Chapels in the Tempio Malatestiano at Rimini. Anyone who has seen them will agree that the author is on the firmest possible ground in extolling these two great buildings at Urbino and Rimini, and his description, on p. 191, of Alberti's sublime achievement is a notable piece of criticism. Whatever, therefore, one thinks of the author's interpretations of the terms "static" and "dynamic," it does become possible at times to see what he would be at, especially as he includes in his list of commended works the far too little-known triumphal arch of Alfonso of Aragon at Naples. Quite rightly also, he draws attention to the superb intarsia woodwork at Urbino, as something not only remarkable in *tour-de-force* execution, but interpretative of the very spirit of the great building which it adorns.

With all this, therefore, to the good, it is a great pity that there is so much in the book that is bound to be wearisome to almost anybody but Mr. Stokes himself. Verrochio's "Lavabo" is undoubtedly an extremely fine piece of work, but it is surely disproportionate to devote to so comparatively slight a thing—in point of human interest—more than six full pages of letterpress. Just as this matter of detail seems overstressed, so some of the matter dealing with Greek art, Etruscan art, etc., if not irrelevant, is, at any rate, rather distracting and discursive. The illustrations are excellent and extremely valuable. Apart from what one must call its excrescences, the book is noteworthy in a strictly limited way, but that must be insisted on.

SYMBOLISM

CHURCH SYMBOLISM. *By F. R. Webber. Introd. by R. A. Cram. Cleveland: J. H. Jansen, 1927. £1 4s.*

Reviewed by THEODORE FYFE [*F.*]

This book, which has a short introduction by Mr. Ralph Adams Cram, is a plain, straightforward account of the principal methods of expressing the symbols of the Godhead, the Sacraments and other rites, the Apostles, the Angelic Beings, the Early Fathers, and other symbols of the Christian Church, mostly associated with the life and teaching of Our Lord. In addition, there is a short section dealing briefly with Old Testament symbolism. The last part of the book, comprising 130 pages, is given over to a valuable "Glossary" of the symbols of the more important Saints of Church Art, the Plates, a Glossary of the more common Symbols, a Bibliography, and an Index.

For the ecclesiastical designer the book is certain to prove very useful, and though it is obviously written from the Catholic standpoint, it is well balanced and avoids extravagance of treatment or of language. A chapter at the end points usefully to the distinction between types (e.g., St. George) and symbols (e.g., The Cross).

The photographic plates are well chosen and valuable, and if considerably more than half of them are given over to modern American work, this shows to advantage how much study Americans have given to the matter; though it seems a little odd that some examples of work by the six English architects mentioned in the Conclusion should not have been selected. As might be expected, the greater number of American examples are from work by Messrs. Cram, Goodhue and Ferguson, either as a firm, or separately. In the older section the illustrations of the lunette of the St. Mark's portal, Venice, and the two great mosaics from Cefalu, Sicily, are effective and unusual. Old work in England is represented by the Prior's Door at Ely, some Celtic crosses, some bench ends, and some symbolic painting and glass from the Temple Church.

Three errata were noticed:—*Blight* for *Bligh* Bond, *Edwin* for *Edward* S. Prior, and on p. 234, two references to Plate *XXVIII* which should be to Plate *XXVII*.

It seems a pity (p. 232) that Dürer should be spelt Duerer, but though this may be American, Cranach cannot be Cranich.

BENCH MARK REVISIONS

RE-LEVELLING OF LONDON. *Commenced January 1931. Abstracts of secondary lines. By H. St. J. L. Winterbotham, Ordnance Survey. Southampton: O.S. Office. 1932. 7s. 6d.*

This book gives the revised values on the Newlyn datum of some 2,400 bench marks in an area extending from Hemel Hempstead and Ware on the north to Godstone on the south, and from Windsor on the west to Stroud and Chelmsford on the east. Each bench mark is described and the Ordnance Survey plan number is given so that there should be no difficulty in the location of any mark. In addition to the latest revised heights based on Newlyn, the last published values on the Liverpool datum are given for purposes of comparison.

There is no doubt that it will prove of great value to architects, surveyors and engineers working in the London area, particularly as it is probable that the revised levels, particulars of which it contains, will not appear on the published plans for a considerable time. The volume can be obtained direct from the Ordnance Survey Office, Southampton, or from booksellers.

RURAL HOUSING

RURAL HOUSING. *By Percy Morris. Pam. Lond.: C.P.R.E., 1932. 3d.*

The paper on Rural Housing, read by Mr. Percy Morris, Devon County Architect, to the C.P.R.E. Conference, at Ashridge, last March, has been reprinted as an amply-illustrated pamphlet, and is issued by the C.P.R.E. at the price of 3d. Mr. Morris restricts his considerations to true rural housing, excluding, that is, the "pseudo urban appendix—what Cobett called the swelling of the wen."

The shortage of rural houses is not simply a legacy of the war. Long before the war there was very little house-building in the country, partly because building for rural workers has never been an economic proposition.

To-day the problem is aggravated in many ways—it is even less an economic proposition than before, and the influx of townfolk, weekenders and the like, to the country has absorbed for what are really semi-urban uses dwellings properly belonging to the rural community. At the same time there has been a demand for a raising of standards which it has been almost impossible to meet in an economic way. The extent to which it has been met is illustrated in Mr. Morris's paper. The solution he advocates is chiefly to be found in reconditioning under the Housing (Rural Workers) Act of 1926. Among the illustrations are many delightful examples of reconditioned houses, one of the most charming of which is from Mr. Morris's own county.

It is often inevitable that in reconditioning it is not possible to attain optimum conditions, the restrictions of an already fixed form are obviously too great to allow of the complete freedom of design desirable; however the careful and sensible requirements of the local authority which Mr. Morris re-states assure a reasonably high standard.

In Devon alone almost 800 schemes (possibly more by the time this review is written) have been approved finally at a charge to the Council of about £3,300. Against this charge must be set the receipts from the increase in rateable value through many uninhabitable or almost derelict cottages being restored to use.

Though the greater part of the paper is devoted to reconditioning, Mr. Morris also deals briefly with some of the problems of new house design and with the administrative and legal machinery of rural housing.

The paper is full of clearly expressed information, and, what is almost more important, good sense, humour and sensibility.

ROCK-CUT TEMPLES AROUND BOMBAY. *By K. H. Vakil. Bombay: D. B. Taraporevala, 1932. Rupees 3.*

Though all Englishmen who have travelled in India have come under the fascination of her architecture, few can pretend to any detailed knowledge or understanding, partly because for Western minds there is such a large gap to be leaped before anything near a complete comprehension can be attained. Numberless non-architectural books, such as *Bengal Lancer* or *My Brother's Face*, have emphasised this, though the difficulty is not even yet fully understood. The whole structure of the dominant Western æsthetic has stood as a barrier, rather than a guide, to the appreciation of other than purely Western art. As soon as the ordinary European is faced with an exotic form, he has, as it were, to re-orientate his ideas before he can even partially comprehend. We are now, it is true, escaping from some part of the bondage to the theories that have seemed to us for so many generations the be-all and end-all of æsthetic theorising; the escape may be merely a piece of mental gymnastics, and probably should be, freeing us to appreciate all forms, but to practise with increased discrimination only the purely indigenous form.

Mr. Vakil has made in this treatise on certain rock temples near Bombay a serious contribution to this widening of our æsthetic vision, for while he succeeds in giving a clear idea of the form of the buildings, he gives, in addition, a clear idea of the history, philosophies and poetry that formed the background to the elaborate pattern of Indian architecture. Thus two types of reader should find the work of value. The student of architecture will find here a good study of a number of Brahmin temples, and the student of æsthetics—also we hope a student of architecture—will find a carefully reasoned survey of art values. The current emphasis on "what" is being represented by architecture and its sculpture and painting is here shifted to emphasis on "how" it is being represented. It is not easy to make a study of values comprehensible to minds not naturally attuned to the underlying ideas, but Mr. Vakil has succeeded.

This book follows an earlier volume by Mr. Vakil on *Ajanta*. It is fully illustrated, though, unfortunately, many of the photographs are so poorly reproduced as to be scarcely worth printing.

BUILDING STONES

SPECIFICATION OF STONE *Report No. 3 prepared by the Manchester Architects' and Builders' Consultative Board, Manchester, 1932. 1s.* (Obtainable from Mr. James Denver, Joint Secretary, 2 Conynham Road, Victoria Park Manchester.)

Reviewed by ALAN MUNBY [*F.*]

This is the third report of the Manchester Architects' and Builders' Consultative Board, which contains in its thirteen pages some useful information on the qualities and erection of building stones, more particularly those found in the Manchester district.

After some prefatory remarks on quality and setting of stones generally, the report proceeds to describe the character of different stones including Portland and Bath, the latter dismissed in these lines as unsuitable for work in the North.

Naturally in so slight a brochure the descriptions of stones are very brief, and Mansfield stone is dealt with in one line as a "magnesian limestone of red flecked and yellow colour." Mansfield Woodhouse is a magnesian stone, but there are also red and white Mansfield building stones which are sandstones; some useful information, however, is given in these notes on local quarries.

The two pages on Lake District Masonry dealing with slate as a building stone are interesting and contain information not to be readily found elsewhere; these are followed by a list of the principal granites used in building, and their characters are given with varieties of finishings.

Methods of dressing free stones are also scheduled, and finally mortars suitable for setting stones are described.

ACCESSIONS TO THE LIBRARY

1931–1932, X

1 SEPTEMBER TO 6 OCTOBER 1932

INCORPORATING NOTES ON RECENT PURCHASES

(*These Notes are published without prejudice to a further and more detailed criticism.*)

Lists of all books, pamphlets, drawings and photographs presented to, or purchased by, the Library are published periodically. It is suggested that members who wish to be in close touch with the development of the Library should make a point of retaining these lists for reference.

Books presented by Publisher or Author marked R.
Books purchased marked P.
* *Books of which one copy at least is in the Loan Library.*

ARCHITECTURE

PROFESSIONAL PRACTICE

KELLY, *publ.*
The London Building Act 1930. By a Barrister-at-Law.
7¼″. 304 pp. Lond.: Kelly's Directories [1931]. 7s. 6d. P.

BROWN (OSWALD M.)
* Architects' accounts.
8¼″ × 5½″. xi + 117 pp. + pl. Lond.: Gee & Co. 1932. 7s. 6d. R.

HISTORY

FIELD (J. E.)
Historical notes on the antiquities of Wallingford.
2nd ed. pam. 8¼″. Wallingford: A. Jenkins. 1925. 6d.
Presented by Mr. G. P. Barker.

GLOUCESTER: GLOUCESTER ROMAN RESEARCH COMMITTEE
Report, 1931-32. (From *Trans.* of Bristol & Glos. Archæol. Socy., liii.)
pam. 8¼″ n.p. 1931. *Presented by Mr. W. H. Knowles* [*Ret. F.*]

This report, like other monographs reviewed below, illustrates the high standard of architectural portrayal and accuracy becoming common in archæological publications to-day. Block and detail plans, sections and ample photographs show the excavation of the south-east tower and adjoining wall of the Roman city. A block plan of the whole Roman city might assist readers unfamiliar with it. Boys from an adjoining school assisted in the work.—H.V.M.R.

BRAKSPEAR (SIR HAROLD)
A West country school of masons. [As shown in mediæval great churches.] (From *Archæologia*, lxxxi.)
pam. 11½″ × 9½″. + pls. Oxford 1931. *Presented by the Author* [*F.*]

DENING (C. F. W.)
* The eighteenth-century architecture of Bristol.
12½″ × 10¼″. xxiv + 191 pp., incl. lxix pls. Bristol, &c.: J.W. Arrowsmith. 1923. £2 12s. 6d. R.

STOKES (ADRIAN)
The Quattro Cento. A different conception of the Italian renaissance. Part one: Florence and Verona. An essay in Italian fifteenth-century architecture and sculpture.
9½″. xv + 240 pp. + pls. Lond.: Faber & Faber. 1932. £1 5s. P.

DRAWING

BUILDING TRADES EXHIBITION, LONDON, 1932.
Catalogue of Royal Academy architectural drawings . . . exhibited. pam. 7¼″. [Lond. 1932]. R.

ORIENTATION

ROYAL INSTITUTE OF BRITISH ARCHITECTS
* Joint Committee on Orientation of Buildings. Report and appendices. (P. J. Waldram, chairman.)
Dossier, printed, typescript and diags. 14″. Lond. 1932. R.I.B.A. (4).

BUILDING TYPES

M. (H. E.)
The Mansion House remodelled 1931.
pam. 8½″. n.p. [1931.] *Presented by Mr. H. E. Matthews.*

This small pamphlet is a faithful and valuable record of the work of restoration completed earlier this year at the Mansion House. Often changes are made in the structure and decoration of important buildings without any permanent record being published, so that historians of a later generation have to unravel the tangled skein of successive changes without the aid of any reliable contemporary account. "H.E.M," the compiler, who has done a useful work, has wisely opened his record by a brief survey of the past architectural history of the building.

CAVIS-BROWN (J.)
An old English hospital, St. Mary's, Chichester. [With sketches by Beresford Pite.]
pam. 8½″. Chichester: Barrett. [19—]. 4d. *Presented.*

DENOON (D. G.)
The statue of King Charles I at Charing Cross. (From *Trans.* of the Lond. & Middlesex Archæol. Soc., N.S., vi.)
pam. 8½″. + pls. Lond. [19—.] *Presented by the Author* [*Subscr.*]

This short but thorough history is well documented, and illustrated by a map, engraving, photograph, and scale drawings—one by Wren. There is a good bibliography. H. V. M. R.

SKINNER (F. W.)
* Types and details of bridge construction. Part i, Arch spans.
9¼″. vii + 294 pp. New York: McGraw Pubg. Co. 1904.
Presented by the Rev. R. Burges, thro' Mr. Francis Hooper [*F.*]

VAKIL (K. H.)
Rock-cut temples around Bombay at Elephanta, *etc.*
7¼″. xx + 160 pp. + pls. Bombay: Taraporevala. [1932.] R.

WEBBER (F. R.)
Church Symbolism.
10¼″. ix + 395 pp. + pls. Cleveland: J. H. Jansen. 1927. £1 4s. P.

[PARISH CHURCH GUIDES]
Bury St. Edmunds, St. Mary; Bexhill; Pevensey; Winchelsea; Brookland; Battle; New Romney
7 pams. 19[26]–32. *Presented by Canon F. E. Carter* [*Hon. A.*]

KNOWLES (W. H.)
The Church of S. John Baptist, Inglesham, Wilts. (From *Trans.* of Bristol and Glos Archæol. Socy., liii.)
pam. 8¼″. n.p. 1931. R. *Presented by Mr. W. H. Knowles* [*Ret. F.*].

Parclose screens in both aisles, seventeenth-century pews, a charming chancel wall-arcade, a Romanesque sculptured slab, and original roofs are features of this ancient church, here adequately described and illustrated by measured drawings, sketches, photographs, and a plan. H. V. M. R.

EELES (F. C.)
St. Decuman's [Somerset]: a history and description of the parish church, and its daughter church of Williton. With a life of St. Decuman by G. H. Doble.
pam. 8¼″ + pls. Williton, etc. 1932. 1s. 6d. *Presented by the Author.*

This is an exhaustive history, in which the architectural description is preceded by documentary evidence and followed by transcriptions of inscriptions on bells and monuments. The biographical note deals with Keltic dedications and their local distribution. Photographs and early views are given, but no plan. H. V. M. R.

HONEYMAN (H. L.) AND WAKE (T.)
The Cathedral church of St. Nicholas, Newcastle upon Tyne. (From *Archæologia Aeliana*, *ix.*)
9″. 98 pp. + pls. Newcastle. 1932. *Presented by the Authors.*

This scholarly monograph is mainly historical, incorporating architectural descriptions in their chronological order; the "Description" of the church, part by part, follows in one of the appendices. These, which bulk so large as to be virtually chapters, include also accounts of the altars, chantries, fraternities, armorials, glass, and monuments. Admirable photographs, engravings, sketches of details, and a dated plan are given, and there is a thorough bibliography. The author shows the open mind of the true scholar: "at any moment fresh information may shed a disconcerting light." H. V. M. R.

LIVERPOOL: LIVERPOOL CATHEDRAL
L— C—. The official handbook. [By] Vere E. Cotton.
8th ed. 8½″. 132 pp.+pls.+plan. L'pool: Cath. Committee. 1932. 1s. R.

POPHAM (EDGAR) AND WELLS (RICHARD)
Round and about Boxgrove Priory. . . By E— P— . . . with a short history [by] R— W—.
pam. 8¼″. Chichester: Southern Pubg. Co. 1932. 1s. *Presented.*

MINISTRY OF HEALTH
Housing, England.—The Housing Consolidated Amendment Regulations, 1932. (Statutory Rules and Orders, 1932, No. 648.)
leaflet. 9¾″. Lond.: H.M.S.O. 1932. 1d. P.

COUNCIL FOR THE PRESERVATION OF RURAL ENGLAND.
[Memoranda:] No. 26. Rural housing. By Percy Morris.
pam. 9¼″. Lond. 1932. 3d. R.

BARNARD (L. W.)
Cheltenham Masonic Hall: its building and history.
8¾″. 24 pp.+pls. n.p. 1932. R. *Presented by the Author* [*F.*]

FORSTER (W. C.)
Ongar Castle. (From *London Naturalist*, 1931.)
pam. 8½″+ plan. Lond. 1932. *Presented.*

ALLIED ARTS AND CRAFTS.

CHIPPING CAMPDEN: ALCUIN PRESS.
An exhibition of selected works by artists and craftsmen of the Cotswolds. . . Catalogue. pam. 8½″×6½″ n.p. 1932. 6d. R.

BUILDING SCIENCE AND CONSTRUCTION

BUILDING TRADES EXHIBITION, LONDON, 1932.
Official catalogue. [With loose plan.]
9½″×7¼″. Lond. [1932.] R.

DRURY (F. E.) AND HASLAM (W. T.)
Mathematics for students of building.
Bk. i. 7¼″ viii+287 pp. Lond.: Ed. Arnold. 1932. 4s. 6d. R.

MATERIALS

MANCHESTER: MANCHESTER ARCHITECTS' AND BUILDERS' CONSULTATIVE BOARD.
Specification of stone. pam. 8¾″. Manchester. 1932. 1s. R.

SCIENTIFIC AND INDUSTRIAL RESEARCH, DEPT. OF: BUILDING RESEARCH
*Bulletin No. 12. The durability of slates for roofing.
pam. 9½″×6″. Lond.: H.M.S.O. 1932. 4d. R.

CONSTRUCTION

LONDON COUNTY COUNCIL
Code of practice for the use of structural steel and other materials in buildings. (Presented with *Building*, journal.)
pam. 7″. Lond. [1932.] R.

SANITARY SCIENCE AND EQUIPMENT

PALLOT (A. C.)
*The engineering equipment of buildings.
8½″×5½″. xii+343 pp.+2 diags. Lond.: Pitman. 1932. 15s. R.

SCIENTIFIC AND INDUSTRIAL RESEARCH, DEPT. OF: BUILDING RESEARCH
Technical paper No. 13. The equivalent temperature of a room and its measurement.
pam. 9½″. Lond.: H.M.S.O. 1932. 6d. R.

CLARKE (J. A.)
Making new buildings safer from fire. [With construction diags.] (From *Fire*, Aug. and Sept.) cuttings. 1932. P.

TOPOGRAPHY

ORDNANCE SURVEY
Re-levelling of London. . . 1931. Abstracts of secondary lines. By H. St. J. L. Winterbotham.
pam. 12¼″×10″. Southampton. 1932. 7s. 6d. R.

REGIONAL AND TOWN PLANNING AND RURAL PRESERVATION

COUNCIL FOR THE PRESERVATION OF RURAL ENGLAND
*Town and country planning. To plan—or not to plan?
pam. 11″×9″. Lond. 1932. R.

PARLIAMENT: ACTS
Town and country planning act, 1932. [22 and 23 Geo. 5, ch. 48.]
pam. 1932. 1s. 6d. P.

COUNCIL FOR THE PRESERVATION OF RURAL WALES
[Memoranda.] No. 8. Powers and duties of local authorities in connection with rural amenities. pam. 8½″ n.p. [1932.] 3d. R.

Maps

LYNTON, LYNMOUTH AND DISTRICT ASSOCIATION FOR THE PRESERVATION OF LOCAL NATURAL BEAUTIES.
[Plan of Watersmeet Valley and request for subscriptions.]
Repro. [1932.] R.

Architects' Dance and Raffle at Olympia

The architectural profession is indebted to Mr. Montgomery for opening the winter session with such an enjoyable function as the Architects' Dance at Olympia. The success of the dance was no doubt due in some degree to the fact that people were caught in that unsettled after-holiday mood when the routine of work is still broken and anything attracts that seems to promise amusement. The excellent object for which the dance was held—to fill the emptying coffers of the Architects' Unemployment Relief Fund—was without question another factor. But primarily the success of the dance was assured by the skilful organisation of Mr. Montgomery and his staff and the energy and initiative of Mrs. Lanchester, the chairman of the R.I.B.A. Social Committee. This is the first big affair that the Social Committee have undertaken and they are sincerely to be congratulated on the result. Whatever the cause, the tickets for the dance were sold out before the dance started and the dining-room and ball-room were crowded. After dinner Sir Raymond Unwin made a short and happy speech in acknowledgment of all Mrs. Lanchester and Mr. Montgomery had done for the success of the evening.

The band was excellent and the floor crowded, but not too much so. In an interval a conjurer held everyone's attention while he did strange things with lighted cigarettes and picked pennies from the heads of his audience. At 1 o'clock the band played God Save the King and the company broke up.

An enjoyable evening is sometimes followed by a rueful day of reckoning, but in this case the reckoning is all that is good. Over £400 was received from the dance and handed over intact to the Unemployment Fund. On the following day the pictures were raffled and the Walcots, the Ernest George, the Raffles Davisons, the Conrades and the other gifts which had been made by architects, artists, exhibitors and others in sympathy with the scheme were scattered to their new homes. Here again all the tickets were sold. A generous friend of Mr. Montgomery's who wishes to be known as "Autumn-tints" doubled the amount received from the raffle tickets so that with donations the total amount from the dance and the raffle which has been paid into the Unemployment Fund is 1,000 guineas.

A letter from the Unemployment Committee expressing their sense of indebtedness to Mr. Montgomery for this magnificent addition to their funds is printed on page 861. Nobody doubted that the dance and the picture raffle would be a success, but perhaps the overwhelming nature of the success astonished even the promoters themselves. The cordial thanks of everyone concerned are due all those who by co-operation in whatever way helped to make it so.

Correspondence

SIR WALTER SCOTT AND LANDSCAPE ARCHITECTURE

121 Victoria Street,
Westminster,
London, S.W.1.
29 September 1932.

To the Editor, JOURNAL R.I.B.A.,—

SIR,—At a time when attention is being drawn to the works of Sir Walter Scott, it is of interest to note what he said with regard to the distinction between landscape gardening and landscape design.

There is a prevailing assumption in these days that landscape design of parks and large gardens and in connexion with roads is a superfluity; and that all that is necessary in planting schemes is to employ a gardener or firm of nurserymen to supply and arrange plants. On this subject Sir Walter wrote:—

> "The degree of mechanical skill which they (tolerably skilful gardeners) possess may render them adequate to the execution of plans arranged by men of more comprehensive abilities, better education, and a possession, as demanded by Price, of the knowledge connected with the higher branch of landscape-painting, and with the works of the first masters.
>
> "The importance of this art, in its more elegant branches, ranks so high in our opinion, that we would willingly see its profession (and certainly it contains persons worthy of such honour) more closely united with the fine arts than it can now be esteemed. The improvers or layers-out of ground would, in that case, be entitled to demand from their employers a greater degree of fair-play than is, in many cases, allowed them at present."

Sir Walter anticipated the objection that might be raised to having artists with such a high standard that only the great and wealthy could employ them. "The rules of good taste," he says, "when exemplified are pretty sure to be followed." He exemplifies this from the progress made on the basis of example in improving pottery and continues:—

> "It (good taste) cannot be established by canons and *dicta*, but must be left to force its way gradually through example. A certain number of real landscapes, executed by men adequate to set the example of a new school, which shall reject the tame and pedantic rules of Kent and Browne, without affecting the grotesque or fantastic, who shall bring back more ornament into the garden, and introduce a bolder, wider, and more natural character into the park, will have the effect of awakening a general spirit of emulation. There are thousands of proprietors who have neither scenes capable of exhibiting the perfection of the art, nor revenues necessary to reimburse the most perfect of the artists, but who may catch the principle on which improvers ought to proceed, and render a place pretty though it cannot be grand, or comfortable though it cannot aspire to beauty."

Probably there are few people to-day who recognise the distinction that should be drawn between landscape design as a fine art, requiring the employment of imaginative qualities and training in principles of design, and gardening as a working art of planting.

As one goes about the country there occasionally comes to view a beautiful piece of landscape that suggests the employment of the art of man. It may be a formal avenue, a great park, a sweep of lawn framed in by garden and wall, or a setting for a building. We do not admire its beauty only because it has the perfect harmonies that lie in all nature's work but also because it is nature adorned by the skilful touch of some artist. Some of these created pictures—works of art perfected through long years—have become public possessions, in whole or in part, and are treasured and preserved. As we look upon them we wonder why it is that new, in comparison with old, developments in parks, parkways, and gardens, look so crude and imperfect in arrangement; and content ourselves with the reflection that it needs time and growth to bring out natural beauty. For example, some lawn may be as perfect a conception of what a landscape will be in another hundred years as that of St. John's College, Oxford, is to-day, but without the eye of the landscape artist we cannot visualise future possibilities of growth and continuous care. Admitting that this reflection may have its justifications in certain cases, these are probably the result of accident rather than design, for city councils and modern landowners do not appreciate, as Scott and great landowners of his period did, the need of landscape design as a basis for securing successful planting in park and garden, as well as proper display of buildings.—Yours faithfully,

THOMAS ADAMS [*F.*].

THE ORIENTATION OF BUILDINGS

19 Hanover Square, W.1.
16 September 1932.

To the Editor, JOURNAL R.I.B.A.,—

SIR,—While congratulating the Committee concerned on the extremely well presented Report on the Orientation of Buildings, I cannot help questioning Section III(*a*) on the Orientation of Hospitals.

The term "or even fossilized" I feel should not have been allowed in a learned report in referring to a form of plan which has become the normal, developed by sound thinkers, both architects and doctors.

With regard to the general argument for light, air and sunshine, there can be, of course, no quarrel, but this section of the report appears to press personal idiosyncrasies on points which are at best very questionable.

My experience as a patient in the public wards of six hospitals has confirmed me in the view that the parallel arrangement of beds is undesirable, or, conversely, that the right-angle-to-the-wall arrangement in an otherwise well-designed ward of normal form is undoubtedly the right one.

In the "standardised" type of plan the patient may lie on either side with the eyes at rest, but in the "parallel" arrangement there is no escape from the unsupportably blinding light.

The smaller groupings of beds with division screens, except possibly of interest in the classification of cases, is in my opinion also unsound.

If there is any meaning in the term "psychological value" it is to be found in the large, unobstructed public ward, which provides constant and varying interest of a mild order probably beneficially stimulating to the patient—at least this again has been my personal experience. Mysterious noises issuing from

the hidden side of a screen would have an irritating effect on any ordinary patient.

That much good has recently come from Sweden is very evident in these days, but it would be a disaster if we too readily adopted the "parallel" arrangement of beds in hospital wards.

Its novelty is a danger, novelty being apparently the quality at the moment most sought after, and this report would appear to carry the full weight of the Royal Institute of British Architects.

The views put forward are theories—by no means generally accepted, and far too personal to appear in the JOURNAL in a form demonstrated by a wealth of diagrams to which they are scarcely entitled and which might appear conclusive to the inexperienced.—I am, Sir, yours truly,

J. E. DIXON-SPAIN [*F.*]

Temple Farm,
Cowley,
Oxford.
27 September 1932.

To the Editor, JOURNAL R.I.B.A.,—

DEAR SIR,—This letter is being written in the hope that, through your journal, I may overcome a difficulty that I find in reading the R.I.B.A. Committee's report on the orientation of school buildings.

On page 792 of your last issue it is stated that "the real problem is (iii) the planning of classrooms so that they receive the maximum amount of sunshine having due regard to" (*a*) weather, (*b*) glare and heat, (*c*) objectionable local conditions; on page 794 "if the most favourable aspect can be decided upon there should be no difficulty," etc.

In order that my difficulty may be understood may I tentatively restate the whole problem as a series of problems, as follows:—

(A) How does the insolation received in a classroom situated on an unobstructed horizontal plane in a still and clear atmosphere vary with aspect? What is the aspect for maximum insolation?

(B) How should a number of classrooms be combined into a school building in order that there may be maximum insolation? What is the aspect of the building?

(C) How should the building be modified so as to avoid glare? What is now the aspect?

(D) How should the building be further modified so as to afford protection against *periodical* extremes of temperature? What is now the aspect?

(E) How should the building be still further modified in order to comply with *local* meteorological conditions? What is now the aspect?

(F) How should the building be yet still further modified in order to comply with *local* peculiarities such as amenities, skyline, economy of land development, etc.? What is now the aspect?

Now it appears from page 792 that each of the three groups of authorities referred to finds that the aspect under D (and perhaps under C, B and A) is along the meridian or nearly so, but they differ in respect of the modification. The difficulty that I experience is to understand how the reconciliation of these three groups of authorities "on the question of aspect alone" results in a S.E. aspect, as stated on page 793; the stage A, B, etc., to which this aspect applies, is not easy to ascertain.

J. WHITE,
Instructor Captain R.N. (Ret.).

PINNACLES OF NORWICH CATHEDRAL TOWER

Stuston Lodge, Diss.
30 September 1932.

To the Editor, JOURNAL R.I.B.A.,—

DEAR SIR,—On a recent visit to Norwich Cathedral I noticed something unusual about the manner in which the four pinnacles at the corners of the tower were set on their bases. In no case were the facets of these polygonal pinnacles parallel to the facets of the tower or those of the octagonal spire, and the pinnacles were not symmetrically placed with regard to the diagonals of the tower.

I came to the conclusion that the pinnacles were pentagonal on plan.

Knowing that the Dean was an enthusiastic archæologist I wrote to him and he kindly put me in touch with Mr. Brown, the surveyor of the Cathedral. He informs me that the pinnacles are pentagonal on plan and that their orientation is irregular, also that these facts have not hitherto been noticed.

The pinnacles are of the same period as the spire, the fifteenth century.

The case must be almost if not quite unique, and it is extraordinary that it has escaped notice so long.— Yours faithfully,

C. H. GALE [*F.*]

LIFTING OF FLOOR TILING

2, Millbank House, Westminster, S.W.1.
15 September 1932.

To the Editor, JOURNAL R.I.B.A.,—

DEAR SIR,—In your issue of 30 April 1932 there is a supplement containing an extract from the notes of the Building Research Station on the above subject, and an interesting letter from the Borough Engineer of Johannesburg appeared in your issue of 6 August.

The particular matter referred to is one with which I have been concerned and relates mainly to a suspended floor of very usual construction measuring 30 feet by 7 feet, laid with ordinary 6 inch by 6 inch paving tiles. After having relaid this floor, the floor below, which was known to be hollow, has practically burst, the tiles having buckled and flaked on the edges under considerable compression. The conditions under which the tiles were laid were perfectly normal, and the floors have not been subject to any load deflection and the screed is quite perfect. The tiles appear to have had no adhesion to their bed.

The behaviour of the tiles is similar to that of wood block flooring which most of us have at some time seen forced away from their bed by their own expansion.

I should be very much obliged to any members who may have had similar experience if they would give me their views as to the probable cause of this action on the part of tiles.—I am, yours faithfully, BROOK KITCHIN [*F.*]

EARLY FOUR-CENTRED ARCHES

Briantcroft,
Milford on Sea, Hants,
14 September 1932.

To the Editor, JOURNAL R.I.B.A.,—

DEAR SIR,—Towards the end of the thirteenth century the Church of All Saints, Milford, Hants, was considerably enlarged, and while the details of the arches between transepts and nave and chapels are those generally assigned to that period, the arches are four-centred, not in the way described by Mr. G. F. Lake in your issue of 10 September, but in the usual Tudor manner. If this is not unique it is surely peculiar.—Yours truly, W. RAVENSCROFT, F.S.A. [*F.*].

The Editor regrets that other correspondence has unavoidably had to be held over until the next issue.

Obituary

GLENN BROWN

A Memoir by Charles Moore

Mr. Charles Moore, the Chairman of the United States Commission of Fine Arts, has contributed to the Journal *the following memoir of Mr. Glenn Brown, who, at his death last spring, was the senior of our Honorary Corresponding Members in the United States. Glenn Brown, who throughout his long and busy life was at the centre of the American architectural world, is chiefly famous for his work as historian and protagonist of the great plan prepared by Pierre L'Enfant for the city of Washington. The story of his labours to get this plan carried out was told by Glenn Brown himself in a volume of memoirs published in* 1931, *which we reviewed in these columns last December.*

Glenn Brown's lasting work in architecture is almost confined to a stone bridge over Rock Creek at Q Street in Washington. There is an offset in the street at the crossing of the creek, so that the line of the bridge becomes the segment of a circle. The bridge-heads are embellished by four full-sized bronze buffaloes, the work of the sculptor A. Phimister Proctor, lover of American animals. Of the many bridges across stream and parkway, Glenn Brown's alone is adequate to the situation and to the monumental character of the nation's capital.

More lasting and more monumental are the two sumptuous volumes, published by the Government, into which he gathered reproductions of the original drawings, designs and plans for the United States Capitol during the century of its growth. After ten years of research he was able to give for the first time a complete architectural history of the building and to establish the succession of its designers and builders. Out of a century of oblivion he rescued the name of William Thornton, whose belated design Washington and Jefferson selected in preference to any one of the many submitted in the competition. Thornton, born of British parents domiciled in the West Indies, was educated as a doctor in Edinburgh and had travelled extensively in Europe. Although never trained in the technicalities of architecture his sense of design was highly developed, and he not only established permanently the style of the Capitol, but also the three residences which he planned are still cherished as among the best examples of early republican architecture. One of them, The Octagon, is the permanent home of the American Institute of Architects.

Glenn Brown gave to Latrobe his proper place. Latrobe, born and technically educated in England, was somewhat contemptuous of the "amateur" Thornton, who gave up architecture first to direct the upbuilding of the city of Washington and finally to become the first superintendent of the United States Patent Office. Latrobe was a favourite of Jefferson, and had much to do with that gentleman's architectural activities, as also did Hoban, a Dublin man, who built and rebuilt the White House. Then came Bulfinch, the first American-born architect to achieve national distinction and to promote a distinct style based on classical precedents.

In the 1850's the Capitol was extended by the addition of wings that more than doubled its original size, thereby requiring a dome more vast than the modest stone structure that had sufficed for half a century. Fortunately Thomas U. Walter, a worthy successor to the distinguished architects named, was selected by President Fillmore to carry out the extensions, and thus the unity and integrity of the building was preserved. Then the elder Olmsted added the marble terrace and the landscape treatment which gave dignity to the chief building of the nation. All of these men, because of their connection with the Capitol, live in Glenn Brown's history, both by the reproduction of their drawings and in their biographies.

Growing out of Glenn Brown's architectural researches came his understanding and appreciation of the plan made at President Washington's behest by Pierre Charles l'Enfant for the development of the city of Washington. During a century of slow growth, limited resources and internal dimensions, the nation had never wholly lost sight of that plan, although it was mutilated and distorted. Even those who invoked its authority often did so to promote their own schemes.

As Secretary of the American Institute of Architects, Mr. Brown used his position to enlist the architectural profession in the restoration of the L'Enfant Plan as the foundation of the improvements made imminent by the self-consciousness of the American people and the growing feeling that the national capital should be made representative of the wealth and power and taste of the nation. To this end, on the one hundredth anniversary of the removal of the seat of government from Phildelphia to Washington, Mr. Brown summoned a group of architects and landscape architects to present, at the annual Institute meeting of 1900, their conceptions of the lines along which such development should take place.

Early in 1901 the United States Senate ordered an investigation and report as to the park system of Washington: D. H. Burnham and C. F. McKim, architects, Augustus Saint-Gaudens, sculptor, and F. L. Olmsted, Jr., landscape architect, made studies in America and Europe. Their textbook was Glenn Brown's *History of the United States Capitol*, and the presentations he had made of the fundamental and vital value of the L'Enfant Plan were instrumental in leading the members of the Senate commission to base their report and their plans on the plan which L'Enfant had designed and George Washington had approved, and which was already the underlying plan of the capital.

In all great movements such as that which through thirty years has been transforming Washington into one of the world's finest capitals, the influence of any one man cannot be altogether segregated and estimated. But the writer of this sketch, who was associated with the movement from its inception, can bear testimony to the prime importance of Glenn Brown's advocacy and guidance and to the intimate relations he sustained with the makers of the new plans.

PROFESSOR E. S. PRIOR

Mr. H. C. Hughes [*F.*] *has contributed the following memoir of Professor Prior*:

Others have written of Edward S. Prior as a young man—centre of a remarkable group of young men who, although in different ways, exercised a profound influence on English architecture, especially domestic architecture, in the early years of the century. The present writer first knew him at the height of his career, when he, a "modernist" of that time, had attained academic recognition and a professorship. Such a kindly professor to his pupils! He would come down into the tiny room where the few men who then "read architecture" in Cambridge worked, and talk and talk—for even his lectures to us were most informal talks—of twelfth century masons in the north cutting their way in the fierce grit stone in the wild loneliness of the Cistercian abbeys to a true Gothic of their very

own; of stones many and varied, and how he had quarried the hillside at Roker, or how he had persuaded makers of simple pottery by the shores of Poole harbour to turn their clay to bricks of every colour from purple to vivid orange for his church at Parkstone; or more delicate clay, cut clean from the bed and not mixed, so that burnt it showed its delicate striations, for tiles to a fireplace; or we would go up to his house and help build in his garden the rough walls and pillars in which the small plants grew so well; or sit by the wide fireplace and learn the kindliness of an artist's home, so free from worldliness and quite free from affectation, too. At no time did Prior have much building entrusted to him: but I think his wife, by her gentleness and faith, helped him to give the whole of himself to each work he did, so that, like the mediæval mason, he could almost live on the job and for it.

And very real achievements those few buildings were, from that lovely little thatched "Barn" at Exmouth, for which Prior startled the Academicians by making a large scale model for the Academy, to the extremely interesting experiment of Home Place, Holt, in which the ground was dug out for a sunk garden and the walls built of the flints so found. Everything else—oak, tiles and bricks—came from very near by, so that the house is the vindication of a theory, and as such was widely discussed, both here and in Germany, where a parallel modernism was taking very firm root.

The experiment of the elders is liable to become the ordinary tradition of their pupils; but I think these buildings will never be surpassed for the perfect sensitivity in the adjustment of colour and material to landscape. "Grey Walls," at Highcliffe, is on an open cliff, with short grass and gorse, close beside a "bunny" or glen which runs down to the sea and is full of little stunted trees, silver-grey with lichen. The colouring and texture of the house seems in perfect accord with the sea and with the pine-protected garden, which he designed for it, running down to the grey sea.

What he always tried, sometimes till they were weary of it, to impress on his pupils, was that his materials and the permanence of them, were the first and last care of an architect: he had nothing but contempt for the drawing-board architect; but, above all, he fought against the ever-growing withdrawal of free choice by which every simple form of construction is hidden behind patents and its cost loaded with royalties. Commercial or professional organisations he distrusted profoundly. Sappy deal, above all, was his abomination, and his anger would flash as he foretold with the fierceness of a Hebrew prophet the sure destruction by dry rot and woodworm of the cities and suburbs of to-day, and at the end of his life he was helping to advise on replanting hardwoods in England. He was all his life a fighter, and I fear that those early days in the Art Workers' Guild, where they fought together in such good temper, were a bad preparation for a prickly university and a distrustful world, and the little laugh that ended his arguments—meant to disarm and to call "friends"—goaded the ordinary antagonist to fury. His dream was to found at Cambridge, where so many researches exist side by side, a school of real research into the fundamentals of building. Perhaps it will come about one day. The war broke his health and ended his architectural practice; but eagerly he helped to re-start the School of Architecture, and tried through failing health and voice to implant in its unregenerate soil the hardy seedlings of his convictions. But the mind goes back most gladly to the earlier days, the stalwart workman at home among his plants, and recalls the tale he used to tell of how Ernest Newton and he once, walking in Westmorland, came to Sizergh Castle, and found that frontier fortress locked and barred. Their ring was answered. "Are you the plumbers to see about the roof?" was asked. "Yes," said Prior promptly, and the two architects were led through the long passages, glancing eagerly through open doors, and left upon the leads. After they had comfortably completed their inspection and filled their sketchbooks, the plumbers presumably went home to fetch their tools!

EDWARD S. PRIOR

In the memories of Professor Prior that have already appeared in the R.I.B.A. JOURNAL, one section of his activities has not been touched upon, but it is one that ought not to be overlooked.

A pupil of Norman Shaw, he was a member of the small group of Shaw's men who somewhere about 1883 founded the St. George's Art Society "for little discussions on architecture and art generally." The relation between the architect and the craftsman was a subject of intense interest to these young men, and there was much talk of the possibility of bringing them more together. With the audacity of youth they decided to invite prominent artists and craftsmen to a meeting in order to discuss the matter, and out of this meeting, which was held on the 15th January, 1884, grew the Art Workers' Guild.

It was Prior who suggested that "the Society should consist of handicraftsmen and designers in the arts," and that it should be called "The Art Workers' Guild."

Prior filled the office of Master of the Guild in 1906, the year in which an International Congress of Architects was held in London under the auspices of the R.I.B.A., and he presided at a Guild meeting specially arranged for and open to all members of the Congress, the subject being "The Work of William Morris."

In the early days of the Guild, there had been much discussion about the importance of arranging to hold exhibitions of the work of craftsmen. It was eventually thought that this purpose would be better served by forming a separate body, but in close association with the Guild, and so in 1888, the Arts and Crafts Exhibition Society came into being. It consisted in the first instance almost entirely of members of the Guild with William Morris as President, and Cobden Sanderson as Honorary Secretary. Prior took an active part in the formation of the new society, and was amongst its early exhibitors. Some years afterwards (in 1902) on the retirement of Cobden Sanderson, Prior took his place as Honorary Secretary and carried on the duties of that office until 1917. When, living as he did in the country and with other and more important duties demanding his attention at Cambridge and elsewhere, he decided to resign and was elected a Vice-President of the Society.

Firm in his conviction that the architects should be in close touch with the craftsmen, he never lost an opportunity of putting this into practice in his building works, which as far as possible he carried out by direct employment of labour under his own control.

In his teaching also, he never ceased to press the importance of this aspect of work, and those of his students who grasped his meaning have reason to thank him for directing their attention in a mechanical age to the importance of craftsmanship in building and architecture.

R. W. S. W.

ROBERT STEPHEN AYLING [*F.*]

Mr. Stephen Ayling,who was well known both within the profession and without as the leading authority in this country on the design of abattoirs, died on 2 August. He began his career as the assistant of the late Mr. Charles Barry. In 1897 he was awarded the Godwin Bursary Prize, and in the same year won the Bethnal Green Public Baths and Wash-Houses Competition, after which he set up a practice of his own. For some years Mr. Ayling studied housing conditions for better-class working girls, and his designs for this type of building include Brabazon House and St. George's House, Westminster, St. Clement's House, Bolsover Street, and the Nurses' Home at Stoke-on-Trent. He did not, however, restrict himself to buildings of this type alone, but was responsible during his

career for such works as a swimming-bath in Maine, U.S.A., stables at Dulwich, a Grosvenor Square mansion, as well as the Electric Light and Power Station in Dublin and six sub-stations.

Mr. Ayling is best known, however, for his work in connection with public abattoirs. At the time of his winning the Godwin Bursary Prize in 1897, very little was known in England about public abattoirs, and little interest was taken. For that reason Mr. Ayling chose it as the subject for research, and during an extended tour abroad he visited and studied the best of the Continental and American abattoirs. In 1909 he read a paper on the subject to the R.I.B.A., and in the same year he was appointed Honorary Consulting Architect to the Model Abattoir Society. From that time onwards he was in close touch with every movement which concerned the building and the improvement of public abattoirs. He prepared several schemes for new buildings, including two for Kettering and Leicester, which because of the War and for reasons of economy were never carried out. The Model Abattoir and Bacon Factory at Letchworth, erected in 1925-6 was the first abattoir of this character to be carried out by Mr. Ayling, and the new Abattoir and Meat Market at Coventry, now nearing completion, was also designed by him.

During his association with the Model Abattoir Society he was a strong advocate for the humane slaughter of animals, and for purposes of illustration he was commissioned to prepare two designs, from which models were made. These were exhibited at the Royal Sanitary Institute Congresses at York and Belfast, and each awarded a silver medal. Mr. Ayling also wrote *Public Abattoirs, their Planning, Design and Equipment*, published in 1908, and in 1913 he compiled a pamphlet enumerating the various replies received from towns where public abattoirs existed. Several lectures on the same subject were given by Mr. Ayling at Sheffield, Bristol, and Southampton, and before the Royal Sanitary Institute Congress at Plymouth. The general improvement in public abattoirs which has been made in England during the last twenty years is largely due to his efforts and interest.

Mr. Ayling was a member of the R.I.B.A. from 1901, being elected a Fellow in 1909. He was a Fellow of the Royal Sanitary Institute, of which he was a Member of Council, and he held various positions such as Examiner in Hygiene and Sanitary Science to the Sanitary Inspectors' Board, and Assistant Examiner in Architecture to the Civil Service Commissioners.

SYDNEY F. EVERSHED [*F.*]

Mr. Sydney F. Evershed, who died after a short illness on 28 June 1932, at the age of 47, had a very useful and varied career.

He was indentured as an architect in the office of Mr. Charles Bullock, of Brighton, in 1900.

From 1902 to 1904 he assisted Mr. Thomas Garrett [*F.*] of Brighton, and from 1904 to 1908 was chief assistant to Mr. H. J. C. Cordeaux [*F.*] East London, South Africa. From 1908 to 1910 he was chief assistant to Mr. F. W. H. Lee [*F.*] of Leamington Spa, and from 1910 to 1913 was chief assistant to Mr. S. F. Harris [*F.*] of Northampton.

From 1913 to 1915 he was deputy Borough Surveyor at Daventry, Northants, and from 1915 to 1917 was District Surveyor at Wantage, Berks.

During the War, 1917 to 1919, he did excellent service with technical units in France and Italy, on his return to civil life becoming Architect and District Surveyor at Newbury, Berks.

From 1924 to his death he was Architect and District Surveyor at Godstone, Surrey.

Mr. Evershed was responsible for the design and carrying out of extensive Housing Schemes at Newbury and Godstone, including main drainage works at Godstone. He also designed the new Council Chamber and offices and mortuary building at Oxted, and before his death the proposed new fire station for the Godstone Rural District Council.

In addition to being a Fellow of the R.I.B.A. he was also a Member of the Institution of Municipal and County Engineers, and a Member of the Royal Sanitary Institute.

He was of a kindly disposition, honest and conscientious in his work, and had many warm friends. In business dealings he earned the affectionate esteem of all who came in contact with him, and his passing is greatly mourned.

ALFRED HERBERT FOSTER [*F.*]

Mr. A. H. Foster, who died in Brisbane in the spring, was for twenty years the City Architect and head of the Brisbane City Council. He was born and educated in that city, and was afterwards articled to Mr. G. Addison, completing his architectural education in England and travelling in France and Italy.

On returning to Brisbane, Mr. Foster joined the Department of Public Works, and in 1913 he was appointed to the position of City Architect to the Brisbane City Council, a position which he held till his death. He was also examiner in freehand and architectural drawing for the University of Queensland, and at one time was in charge of the drawing school at the Brisbane Technical College. He was recently appointed a member of the Architects' Registration Board of Queensland and of the Valuation Appeal Board. In 1927 he was elected a Fellow of the R.I.B.A.

Amongst the works planned and executed by Mr. Foster and his Department are the Wattlebrae Block at the General Hospital, Anzac Square, Maritime Buildings, Petrie Bight and Ryan House. Mr. Foster's death is a great loss to Brisbane, where he was well known as an efficient and successful worker and a great public figure.

THOMAS HANDY BISHOP [*A.*]

Mr. Bishop was born at Leighton Buzzard, and during his lifetime took an active part in the administration of the town affairs. He qualified as an Associate of the Royal Institute of British Architects for 40 years, during which time he held an appointment in the Architects' Department of the Admiralty, also being engaged by the Argentine Government.

In August 1914 he was appointed Surveyor to the Eaton Bray Rural District Council, and was in charge of the extensive housing schemes carried out by the Wing and Eaton Bray Rural Council.

He also wrote extensively on technical points in connection with sanitation and architecture.

For many years he was a member of the Leighton Buzzard Urban Council, and gave valuable assistance as the chairman of the Works Committee. He was a prominent Freemason and held several orders, including that of Past Provincial Grand Standard Bearer. His other activities included that of Chairman of the West Beds. and Eaton Bucks Building Society, Chairman of Leighton Buzzard Angling Club, a trustee of the Church Room, and a sergeant in the Special Constabulary.

STANLEY EMPSALL [*L.*]

Mr. Stanley Empsall died recently at Sanderstead at the age of 45. He belonged to a well-known Brighouse family, and as a youth was articled to Mr. George Hepworth. After serving his articles he went to Skipton, Doncaster and Grimsby, in all of which centres he was engaged in town-planning work. On the outbreak of war he joined the Royal Engineers and was later transferred to the R.A.F., rising to the rank of Captain. After the war he spent twelve months working in Germany and he visited nearly all the important centres during that period. On returning to England he was offered an appointment under the Air Ministry Works and Buildings Department, and he remained in the service of the Ministry until his death. He held posts at Folkestone, Kenley, and at the Air Ministry Headquarters in London, and four years ago he was sent out to Cairo to supervise work at the Heliopolis Aerodrome, a position which he held for three years.

Notes

The following letter from Mr. Maurice Webb, Chairman of the Unemployment Committee, has been circulated to the Press:—

ARCHITECTS' UNEMPLOYMENT COMMITTEE

10 October 1932.

To the Editor, JOURNAL R.I.B.A.,—

DEAR SIR,—I shall be grateful if I may make use of your columns to express publicly our deep appreciation of the efforts made by Mr. Montgomery at Olympia on behalf of our Unemployment Relief Fund and our pleasure and gratification at the magnificent result. As already announced elsewhere, the proceeds of the dance and the raffle total 1,000 guineas.

Mr. Montgomery's large and numerous donations to the Architects' Benevolent Society are well known and appreciated in the architectural profession and this year he has found additional scope for his generosity (for the Architects' Benevolent Society has received as usual a cheque for £100) in the emergency Relief Scheme now being run for architects who are out of work. It has already been mentioned, but we may be allowed to draw attention to it again, that though the dance was run—and most efficiently run—by the Social Committee of the R.I.B.A. under the chairmanship of Mrs. Lanchester, the expenses connected with it were borne by Mr. Montgomery, so that all payments received from the tickets were made direct and without curtailment to the Fund. The raffle scheme was started originally at the suggestion of Mr. Phillips Dales and was particularly fortunate in that a friend of Mr. Montgomery's, who wishes to be known as "Autumntints," doubled the amount received from the sale of the tickets. It may be added that we are indebted still further to Mr. Montgomery for the final donation which brought the total to the rounded completeness of the final figure.

The Unemployment Committee have been employing some 50 men for the past six months. With Mr. Montgomery's help that number has now been raised to 60. There is still a long waiting list and we are looking to those members of our profession who have not yet subscribed to the Fund to give us all the help they can in relieving the painful position of those whose work has been stopped and who are faced with the anxious problem of finding employment when there is none to be had. Mr. Montgomery has given an inspiring example of service to a cause which we believe to be good and worthy of the support of every member of our profession.—I am, Yours faithfully,

MAURICE E. WEBB,
Chairman,
Architects' Unemployment Committee.

LONDON UNIVERSITY EXTENSION LECTURES

During the coming session of the University of London extension lectures, Sir Banister Fletcher, P.P.R.I.B.A., will give a course of twenty-four weekly lectures on the "History of Ancient Architecture" at the L.C.C. Central School, Southampton Row. The lectures are on Wednesdays at 6 p.m. and the course started on 5 October. Mr. W. H. Ansell [*F.*] is to give a course of lectures on the "Architecture of the Dwelling-house" at the Bec L.C.C. Literary Institute, Beechcroft Road, Tooting, S.W.17. The lectures, which start on 18 January, are to be on Wednesdays at 8 p.m.

THE SCIENTIFIC ASPECT OF BUILDING

The R.I.B.A. Board of Architectural Education and the Director of the Building Research Station, Watford, have made arrangements for holding "Refresher" courses of one week's duration each for architects in practice. The courses, which will be limited to 20 members each, and will be held during February and the following months, will deal primarily with the application of the latest work of the Building Research Station to architectural practice.

They are open to all members of the R.I.B.A. and its Allied Societies. Members wishing to take part should send their names to the Secretary of the R.I.B.A. Board of Architectural Education, 9 Conduit Street, W.1, so as to reach him not later than 1 January 1933.

Arrangements have also been made for the Schools of Architecture recognised for exemption from the examinations of the Royal Institute of British Architects to nominate their construction masters to go to the Building Research Station for a short course to be held in February 1933.

TWO SURREY VILLAGES

At the instance of the Art Standing Committee, an Exhibition of eighty pencil sketches of Oxted and Limpsfield, made by Mr. Arthur Keen as Village Records, will be held in the East Gallery at 9 Conduit Street, from 8 till 16 November. The drawings are not for sale.

NATIONAL HOUSING AND TOWN PLANNING CONFERENCE

The National Housing and Town Planning Council is to hold a National Conference at Scarborough from Friday, 25 November, to Monday, 28 November. On Friday evening Mr. Frank M. Elgood, C.B.E. [*F.*], will read a paper on the administration of the Town and Country Planning Act, 1932, and both the morning and afternoon sessions on Saturday are to be devoted to a discussion on the administration of the Housing Acts, 1924 and 1930. On Sunday there is to be a paper by Mr. D. C. L. Murray, M.C., M.A., on "The Powers of Local Authorities and the Duties of the Public in Safeguarding the Amenities of the Countryside." Those who wish to attend are asked to write to the Secretary of the National Housing and Town Planning Council, Mr. John G. Martin, 41 Russell Square, W.C.1.

THE ARCHIBALD DAWNAY SCHOLARSHIPS, 1932–1933.

In accordance with the terms of the will of the late Sir Archibald Dawnay, the Royal Institute of British Architects have awarded one scholarship of £75 for the academical year 1932–1933 to Mr. A. W. Varcoe, of the School of Architecture, Edinburgh College of Art, and one scholarship of £50 for the academical year 1932–1933 to Mr. M. G. Gilling, of the Liverpool School of Architecture, University of Liverpool.

Mr. J. R. Baxter, of the Liverpool School of Architecture, University of Liverpool, who was awarded a scholarship of £75 for the academical year 1931–1932, and Mr. D. L. Couves, of the Armstrong College School of Architecture, University of Durham, who was awarded a scholarship of £50 for the academical year 1931–1932, have been granted renewals of their scholarships for the year 1932–1933.

The scholarships are intended to foster the advanced study of construction and the improvement generally of constructional methods and materials and their influence on design.

THE INSTITUTION OF HEATING AND VENTILATING ENGINEERS

During the coming session the following papers of importance to architects are to be read to the Institution of Heating and Ventilating Engineers :—

7 December, Dr. Oscar Faber, O.B.E. [*Hon. A.*] :
"Examples of Modern Heating, Ventilating and Electrical Installation."

8 February, Mr. Edgar Herring, M.I.Mech.E.:
"The Warming and Ventilation of the Masonic Peace Memorial Building, London."

SIR JOHN SOANE'S MUSEUM

The Soane Museum, 13 Lincoln's Inn, W.C., will be open free on Thursdays and Fridays during October from 10.30 a.m. to 5 p.m., and during November from 10.30 a.m. to 4 p.m.

APPOINTMENTS

Mr. Leonard Heywood [*A.*] has been appointed housing director to the Manchester Corporation. For the last three years Mr. Heywood has been deputy to Mr. F. W. Platt, whom he succeeds.

Mr. W. W. Wood [*F.*], of Plymouth, has been appointed principal of the Chelmsford School of Art and Technology.

THE INTERMEDIATE EXAMINATION.

The following are the dates on which the forthcoming R.I.B.A. Intermediate Examination will be held :—

18, 19, 21, 22 and 24 November 1932.

(Last day for receiving applications : 18 October 1932).

ARCHITECTS' UNEMPLOYMENT RELIEF FUND

The following donations to the Architects' Unemployment Relief Fund have been received since the last list was published in the JOURNAL:—

	£	s.	d.
Mr. H. T. Jenkins (Marble Works, Torquay)	52	10	0
Mr. Richard C. Ball	10	0	0
Mr. G. F. S. Streatfeild (in addition to a subscription)	5	5	0
Mr. G. Davidson	5	0	0
Mr. John P. White	2	2	0
Professor Frank Granger	2	2	0
Mr. R. Howden	2	2	0
Mr. H. A. Battley	2	2	0
Mr. F. D. Danvers	1	1	0
Mr. Andrew Gray (2nd donation)	0	10	6

Allied Societies

NORFOLK AND NORWICH ASSOCIATION OF ARCHITECTS.

An Exhibition of photographs of work designed and executed by practising members of the Norfolk and Norwich Association of Architects was opened at the Castle Museum, Norwich, on Saturday, 30 September, by the Deputy Lord Mayor, Dr. G. S. Pope. The Exhibition consisted of some 350 photographs of buildings of all types erected both in Norfolk and elsewhere during the last nine years, including such important buildings as that of Barclays Bank, Norwich, and the College of Technology and Art, Rotherham, as well as a number of smaller houses, chapels, cinemas, etc.

Mr. Upcher, the President of the Association, in his opening speech, remarked that the mistakes of an architect cannot be hidden, but in defence he pointed out the many difficulties confronting the architect : in particular, the difficulties of cost and clients.

Dr. Pope, in opening the Exhibition, said that it was a tribute to the excellence of the houses built by Norfolk architects that the people occupying them had come to the Exhibition. Since the Sixth Day of the Creation it had been the work of the architect to furnish the surface of the earth fittingly, and in modern times, when it was becoming increasingly difficult to keep the countryside beautiful, it was more than ever necessary that the public should be educated by architects. He referred to the work of Norfolk architects, both in Norwich itself and all over England, as being worthy of the magnificent architectural heritage which had come to the city from the past. Dr. Pope referred particularly to the competitive designs for two notable buildings in the city, the Municipal Buildings and the Town Hall. In conclusion, he said that the work of Norwich architects had travelled far and that their buildings had taken a place in the hearts of cities and towns all over England, beinging credit to the name of Norwich and to the Association.

Mr. P. W. Jewson, President of the Norfolk Society, proposed a vote of thanks, and said that no body of men were more willing in the service of their city than the Norfolk architects of the day.

MANCHESTER SOCIETY OF ARCHITECTS.

The third of this year's series of summer visits was paid on Wednesday evening, 31 August, to St. Nicholas' Church, Kingsway (Architect, Mr. N. F. Cachemaille-Day, A.R.I.B.A.), and to St. Chad's Church, Cheadle (Architect, Mr. W. B. Edwards, A.R.I.B.A.). The visit was well attended and the two churches afforded an interesting comparison between the definite modernism of the former and the more traditional detail of the latter.

The thanks of the Society are due to the clergy and the architects of the two churches for their kindness in arranging the visits.

The last of the summer visits was paid on Wednesday evening, 14 September, to the Stretford Town Hall, now being built to the designs of Messrs. Bradshaw Gass and Hope, members of whose firm conducted a large number of members of the Society round the building.

A very complete set of drawings was on exhibition, and was explained by Mr. Adamson.

Unemployed local labour has been used for much of the work by arrangement with the Ministry of Health, which is affording some interesting experience to both architects and builders.

The best thanks of the Society are due to the authorities, to Messrs. Bradshaw Gass and Hope and to Messrs. Marshalls, the contractors, for their kindness in permitting the visit to be held and for the admirable facilities for inspecting the drawings.

NORTH WALES ARCHITECTURAL SOCIETY.

The above Society were recently able to obtain the loan of the Premiated and Commended designs in the recent competition of the R.I.B.A. premises, and they were exhibited during the period 10–17 September, in the Pritchard-Jones Memorial Hall of the University College of North Wales at Bangor.

On the first day of the exhibition the members of the Society met at the University College and interesting discussions took place regarding the merits of the various designs. The draughtsmanship of a number of the drawings received some trenchant criticism, particularly from the younger members.

We are indebted to the competitors for allowing their drawings to be exhibited and feel that we in this "tucked away" part of the British Isles have been able to put before our junior members something interesting and which, at the same time, will give them food for thought, especially in the event of any of them, later, going in for competitions on a large scale.

Notices

THE INAUGURAL GENERAL MEETING

MONDAY, 7 NOVEMBER 1932, AT 9 P.M.

The Inaugural General Meeting of the Session 1932–33 will be held on Monday, 7 November 1932, at 9 p.m., for the following purposes :—

To read the Minutes of the Fifteenth General Meeting of the Session 1931–32 held on 13 June 1932.

Sir Raymond Unwin, President, to deliver the Inaugural Address of the Session.

EXHIBITIONS IN THE R.I.B.A. GALLERIES

The following Exhibitions have been arranged:—

1. Designs by Students of Schools of Architecture recognised for exemption from the R.I.B.A. Final Examination, 13 to 22 October (inclusive), 10 a.m. to 8 p.m. (Saturdays 10 a.m. to 5 p.m.).

2. Designs by Students of Schools of Architecture recognised for exemption from the R.I.B.A. Intermediate Examination, 27 October to 4 November (inclusive), 10 a.m. to 8 p.m. (Saturday 10 a.m. to 5 p.m.).

3. An Exhibition of pencil sketches by Mr. Arthur Keen [*F.*] of village buildings, parish churches and farmhouses in Oxted and Limpsfield, Surrey.

The Exhibition will be open from 8 to 16 November inclusive between the hours of 10 a.m. and 8 p.m. (Saturday 10 a.m. to 5 p.m.).

BRITISH ARCHITECTS' CONFERENCE, 1933.

The Annual Conference of the R.I.B.A. and Allied and Associated Societies will be held in Cambridge from 21 to 24 June 1933.

ANNUAL SUBSCRIPTIONS

Members' subscriptions, Students' and Subscribers' contributions became due on 1 January 1932.

The amounts are as follows:—

Fellows	£5 5 0
Associates	£3 3 0
Licentiates	£3 3 0
Students	£1 1 0
Subscribers	£1 1 0

NOTE.—By a resolution of the Council dated 20 July 1931, the subscriptions of R.I.B.A. members in the Dominions overseas who are also members of allied societies in those Dominions are reduced to the following amounts as from 1 January 1932:—

Fellows	£3 3 0
Associates	£2 2 0
Licentiates	£2 2 0

COMPOSITION OF SUBSCRIPTIONS FOR LIFE MEMBERSHIP

Fellows, Associates and Licentiates of the Royal Institute may become Life Members by compounding their respective annual subscriptions on the following basis:—

For a Fellow by a payment of £73 10s. (70 guineas).

For an Associate or Licentiate by a payment of £44 2s. (42 guineas), with a further payment of £29 8s. on being admitted as a Fellow.

In the case of members in the Dominions overseas who are members of Allied Societies in those Dominions, the following basis will operate:—

For a Fellow by a payment of £52 10s. (50 guineas).

For an Associate or Licentiate by a payment of £31 10s. (30 guineas), with a further payment of £21 (20 guineas) on being admitted as a Fellow.

Provided always that in the case of a Fellow or Associate the above compositions are to be reduced by £1 1s. per annum for every completed year of membership of the Royal Institute after the first five years, and in the case of a Licentiate by £1 1s. per annum for every completed year of membership of the Royal Institute, with a minimum composition of £6 6s. in the case of Fellows and £4 4s. in the case of Associates and Licentiates.

NEW CLASSES OF RETIRED MEMBERS

Under the provisions of the revised Bye-law No. 15 applications may now be received from those members who are eligible for transfer to the class of "Retired Fellows," "Retired Associates," or "Retired Licentiates."

The revised Bye-law is as follows:—

"Any Fellow, Associate or Licentiate who has reached the age of fifty-five and has retired from practice may, subject to the approval of the Council, be transferred without election to the class of 'Retired Fellows,' 'Retired Associates,' or 'Retired Licentiates,' as the case may be, but in such case his interest in, or claim against the property of, the Royal Institute shall cease. The amount of the annual subscription payable by such 'Retired Fellow,' 'Retired Associate' or 'Retired Licentiate' shall be £1 1s. 0d., or such amount as may be determined by resolution of the Council, excepting in the case of those who have paid subscriptions as full members for thirty years, and who shall be exempt from further payment. A 'Retired Fellow,' 'Retired Associate,' or 'Retired Licentiate' shall have the right to use the affix of his class with the word 'Retired' after it, shall be entitled to receive the JOURNAL and *Kalendar*, shall be entitled to the use of the Library, and shall have the right to attend General Meetings, but shall not be entitled to vote. A 'Retired Fellow,' 'Retired Associate' or 'Retired Licentiate' shall not engage in any avocation which in the opinion of the Council is inconsistent with that of architecture. Nothing contained in this Bye-law shall affect the rights of persons who at the date of the passing of this Bye-law are members of the classes of 'Retired Fellows' and 'Retired Members of the Society of Architects.' "

OVERSEAS APPOINTMENTS

Members contemplating applying for appointments overseas are recommended to communicate with the Secretary R.I.B.A., who will supply them with any available information respecting conditions of employment, cost of living, climatic conditions, etc.

Competitions

STOCKHOLM: TOWN PLANNING COMPETITION

The City of Stockholm, through its town planning board, invites proposals for a town planning scheme to cover the area designated Lower Norrmalm, which occupies a central position in the city. The object of the competition is to secure preliminary proposals for a solution of the town planning problem, which would enable a gradual reconstruction of this district to be carried out, with due regard to the present requirements as to the capacity of the streets and the supply of light and air for the blocks of houses.

Proposals submitted will be examined by a committee consisting of the following:—

Harry Sandberg, Civic Councillor, Stockholm (Chairman).
Dr. Yngue Larsson, Civic Councillor, Stockholm (Vice-Chairman).
Gustaf Ahlbin, Stockholm.
E. G. Asplund, Stockholm.
Carl Bergsten, Stockholm.
Hermann Jansen, Berlin.
Albert Lilienberg, Director of Town Planning, Stockholm.
Professor Ragnar Ostberg (Hon. Corresponding Member R.I.B.A.), Stockholm.
George L. Pepler, London.

Premiums: 20,000 Kr. (approx. £1,000)
15,000 Kr. (approx. £750)
10,000 Kr. (approx. £500)

and further amounts to bring the total prize money up to 60,000 Kr.

Last day for sending in proposals: 1 March 1933.

Last day for questions: 1 August 1932.

Documents dealing with the competition may be obtained on application to the Registrar, Town Planning Office, Stadshuset, Stockholm. Deposit 40 Kr. (approx. £2).

Members' Column

PARTNERSHIP WANTED

L.R.I.B.A., 20 years' experience, desires partnership or position with view to same. Small capital available. Apply Box No. 2192, c/o Secretary R.I.B.A.

FELLOW of the Institute and of the Surveyors' Institution, etc., lately relinquished high official appointment in the East, requires a position or a partnership. Highest references. Some capital available. Box No. 8102, c/o Secretary R.I.B.A.

Practising Architect (32), now slack, would like working partnership with busy firm, or would take over practice and allow retiring Architect annual allowance for life, or any other reasonable arrangement. Abroad not objected to. Apply Box No. 5102, c.o. Secretary R.I.B.A.

SHARE OF OFFICES TO LET

ARCHITECT occupying offices and flat near Portman Square offers share of same (or office only), also part services of draughtsman and typist if desired. Apply "*Doric*," c/o Secretary R.I.B.A.

MEMBER has share of office to let in the City. Rent £50 per annum inclusive ; *or* would consider sharing another office in City, Victoria or W.C. district. Box No. 2082.

MEMBER, practising in Old Queen Street, Westminster, offers well-lit furnished room : shorthand, typing, etc., available. Rent, including electric light, £48 per annum. Box No. 3092, c/o Secretary R.I.B.A.

CHANGE OF ADDRESS

MESSRS. ALFRED AND DAVID OSPALAK, 25 Victoria Street, S.W.1, are moving on 1 October to more commodious offices at 13 and 15, Old Queen Street, Westminster, S.W. Telephone numbers : Whitehall 3324, 3325 and 3326.

MR. LAWRENCE WRIGHT, A.R.I.B.A., has moved to No. 8 Garway Road, London, W.2. (Telephone : Bay 3837.)

MESSRS. HOME AND KNIGHT, FF.R.I.B.A., have changed their address to 3 Verulam Buildings, Gray's Inn, W.C.1. (Telephone : Chancery 7430.)

SHARE OF OFFICE REQUIRED

MEMBER, age 36, wishes to rent room or share office with a London architect who would be glad of occasional assistance. Apply Box No. 7102, c/o Secretary R.I.B.A.

NEW PRACTICE

MR. IVOR DAVIES begs to announce that he has commenced practice at 55 High Street, Bangor, N.W., and will be pleased to receive trade catalogues, etc.

TRADE CATALOGUES WANTED

L. M. CHITALE, A.R.I.B.A., A.M.P.T.I., Chartered Architect and Town-Planning Consultant, c/o Modern Hindu Hotel, Mount Road, Madras, India, would be pleased to receive trade catalogues, samples of materials and any other information useful for all types of buildings in India.

A.B.S. INSURANCE DEPARTMENT.
HOUSE PURCHASE SCHEME

(for property in Great Britain only).

Further Privileges now Available.

The Society is able, through the services of a leading Assurance Office, to assist an Architect (or his client) in securing the capital for the purchase of a house for his own occupation, on the following terms :—

AMOUNT OF LOAN.

Property value exceeding £666, but not exceeding £2,500 75 per cent. of the value.

Property value exceeding £2,500, but not exceeding £4,500, 66⅔ per cent. of the value.

The value of the property is that certified by the Surveyor employed by the Office.

N.B.—Legal costs and survey fees, and, in certain cases, the amount of the first quarter's premium payment will be advanced in addition to the normal loan.

RATE OF INTEREST.

In respect of loans not exceeding £2,000 5½ per cent. gross.
" " in excess of " 5¾ " "

REPAYMENT.

By means of an Endowment Assurance which discharges the loan at the end of 15 or 20 years, or at the *earlier death* of the borrower.

SPECIAL CONCESSION TO ARCHITECTS.

In the case of houses in course of erection, it has been arranged that, provided the Plan and Specification have been approved by the Surveyor acting for the Office, and the amount of the loan agreed upon, and subject to the house being completed in accordance therewith, ONE HALF of the loan will be advanced on a certificate from the Office's Surveyor that the walls of the house are erected and the roof on and covered in.

NOTE.—Since 1928, over £50,000 has been loaned to architects under this scheme, and as a result over £600 has been handed to the Benevolent Society.

If a quotation is required, kindly send details of your age next birthday, approximate value of house and its exact situation, to the Secretary, A.B.S. Insurance Department, 9 Conduit Street, London, W.

Members sending remittances by postal order for subscriptions or Institute publications are warned of the necessity of complying with Post Office Regulations with regard to this method of payment. Postal orders should be made payable to the Secretary R.I.B.A., and crossed.

It is desired to point out that the opinions of writers of articles and letters which appear in the R.I.B.A. JOURNAL must be taken as the individual opinions of their authors and not as representative expressions of the Institute.